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THE BERLINER CASE.

It has been decided that the Berliner case is to go before the United States Supreme Court, where it will be heard in September. An important point to be brought before the Court by the government will relate to the validity of the recent decision of the Circuit Court of Appeals. It is reported that the counsel for the government will contend that the statute creating the United States Courts of Appeal does not give these courts jurisdiction in a cause such as the one in question. Heretofore all the limitations due to the peculiar relations of the government with the case at suit have adversely affected its side of the case alone, so that the new issue thus introduced will give an aspect of fair play heretofore lacking. It is not plain, however, in what manner the point referred to can affect the case, unless, if established, the decision of Judge Carpenter is thereby rendered final.

RELATION BETWEEN MAXIMUM INDUCTION AND REMANANCE.

Prof. Fessenden in another column publishes the result of some experiments which confirm, within practical limits, a possible magnetic law recently announced through these columns by Messrs. Houston and Kennelly. The latter found by a discussion of data bearing on the subject, given by Prof. Ewing, that the remanent magnetism in iron or steel is a linear function of the maximum induction to which the material has been subjected. That is, the remanent magnetism is the product of a constant into a value found by subtracting another constant from the maximum induction. For example, it was found that if 400 gausses be subtracted from the maximum induction to which certain samples of soft iron experimented with by Prof. Ewing were subjected, and the remainder then multiplied by .88, the final product agreed very closely with the experimental data through a large range. Prof. Fessenden found this linear law to hold throughout a practical range, and concludes that it may therefore be accepted as correct, since the divergences at the highest and lowest limits do not affect its value for ordinary purposes. Should additional experiments, as seems probable, still further confirm the results thus far arrived at, magnetism will be enriched by an extremely simple relation, and one having a practical bearing.

TRANSFORMERS.

The paper read by Prof. D. C. Jackson at the Chicago convention of the Northwestern Electrical Association, which we reprint elsewhere, should prove very useful to station managers, and furnishes an example of a class of papers which might more frequently be added to on similar occasions by college professors. Prof. Jackson places within reach of the practical man not only the methods of testing transformers and data for his guidance to interpret the results obtained, but also the principals involved in the selection of transformers for a particular service. One factor is omitted—that referring to the heating limit—which, however, while being perhaps the most important to the designer, will rarely need to be determined by the purchaser of the usual commercial transformers. As will be seen, the ratio of copper to iron losses is one which depends upon the character of load carried by the transformer, the most efficient ratio for a large load factor differing considerably from that for a small load factor. The data and directions given in the paper are sufficient to enable a central station manager, by the mere reading of station forms of instruments and simple arithmetical calculations, to test his apparatus by methods as scientific as they are practical, and the information given places it within his power to make an

ideal selection for the conditions of a given case. In the past everything was mere guess work in the selection of transformers, and while the principles enunciated by Prof. Jackson are not new, much credit is due him for thus placing them within reach of the practical man.

ANOTHER PATENT DECISION.

The decision of Judge Showalter in the two-carbon arc lamp case, an abstract of which we print elsewhere, adds another to the long list of evidence accumulating against our patent system. Whether Judge Showalter is right and the several judges who took an opposite view are wrong, or vice versa, it is not creditable to our system of patent law that under it such extremes of interpretation should be possible. Were this an isolated case, the subject might be dismissed with the remark that it is illustrative of the uncertainties of law that reign in all branches of jurisprudence, but, unfortunately, in patent law we seem to have nothing else than uncertainties. This is undoubtedly due to the fact that in this branch of law there is an almost entire lack of general principles, whose presence in other departments of jurisprudence adds the stability so necessary in the dispensation of justice. Were our courts so constituted that each case could be tried upon its real merits, which implies judges competent to consider the technical merits at issue, no great harm would result from the present state of patent law. But with courts sitting in judgment on technical questions who, in most instances, are ignorant of the scientific points concerned, and still less capable of appreciating the mechanisms in which they enter, the existence of a body of principles to which they may apply for guidance is peculiarly desirable. Lacking such authoritative guidance, it is but natural that a judge should according to his habit of mind, evolve general considerations, and we thus find that in one case the decision turns on the question of the personalities of contesting inventors, in another on a supposed enormous difficulty overcome by the patent in suit, for which the inventor should have unusual credit, in another on lexicographical considerations, and so on. If our present patent courts are to be maintained there truly exists an aching void for a Grotius or a Story.

SINGLE AND DOUBLE-CARBON ARC LAMP.

A witness in the recent double-carbon Brush arc lamp case testified that ordinary mechanical skill would have enabled one to obtain all-night service from almost any type of the numerous so-called single-carbon lamps in use prior to 1884, and that the double-carbon lamp came into vogue merely from the force of fashion, if that word may be used in this connection. To emphasize the point made, he added the remark that as long as women are so foolish to wear hooped skirts, manufacturers will not only be willing to supply them with such, but will assist in keeping such hoop skirts in fashion. While the testimony of this witness was *ex parte*, yet the point he makes seems to be one of some weight. Several years ago it was a matter of extreme difficulty to sell an all-night single-carbon arc lamp for street lighting purposes, not because it was objected to by a prospective purchaser on account of any knowledge of inefficiency or insufficiency, but partly for the reason that he did not care to depart from the almost exclusive practice of the country, and partly from fear of litigation. The general use of the double-carbon lamp was, of course, a weighty selling point and was worked to its full extent. In one instance, an agent testified before the council of a village examining into the merits of different systems of street-lighting, that there was not a single-carbon lamp in the United States that would burn all night, and was put into a rather embarrassing position when the chairman of the council requested him to step to a window and see some all-night single-carbon arcs visible in a contiguous town, where they had been in the most satisfactory use for some months. It is nevertheless singular that single-carbon lamps did not come into more general use in this country during the period of the double-carbon lamp monopoly, for here fashions in commercial matters are not expected to have much vogue. The fact, however, that the single lamp is used almost exclusively in Europe for all-night lighting, and in this country has given satisfaction where a fair trial was accorded, would seem to indicate that the great value of the double-carbons arc lamp monopoly—and which remains a monopoly though in the enjoyment of several instead of one—was partly due, at least, to fashion.

MAGNETIC SYMBOLS AND UNITS.

Elsewhere we reprint an article from the pen of Prof. Hospitalier on the subject of symbols for magnetic units, and also an abstract of a paper by Prof. Oliver Lodge on the subject of magnetic units, the latter having been prepared for the coming meeting of the British Association for the Advancement of Science. Were an illustration sought for English internationalism as expounded by Prof. Hospitalier, a better example than the paper of Dr. Lodge it would be very difficult to find. Though the question of scientific units is essentially an international one, the English writer proceeds to consider it as if its geographical boundaries were those of the British isles and that, perforce, all other countries would, willy nilly, have to accept the English solution. Notwithstanding the adoption and definition by the Chicago International Electrical Congress of the henry as the unit of inductance, and its legalization by act of Congress in this country, the paper merely states that, "It has been practically decided in America that this unit shall be named after Prof. Henry, of Washington, but the precise definition has not yet been agreed upon." This is the only reference in the paper to any non-English action on the question of units, and "Prof Henry, of Washington," is the only non-English name mentioned. Though recognizing the name "henry," the paper suggests as a value for unit inductance, 10^9 times the C. G. S. unit, the present value of the henry being 10^8 C. G. S. units. It very fortunately happens that the suggestions of Prof. Lodge will have to stand criticism before the B. A., and, still more fortunately, that final action in the question of units will rest with Kelvin, Rayleigh, J. J. Thomson, Ewing and others, who will be inclined to take the liberal view of the subject which its nature demands. Prof. Lodge in his paper states that, "It need hardly be said that in the last resort it rests with practical men to employ or decline any suggested system of units." What fate, at the hands of the "practical men" of the United States, France and Germany, would be met by a system of units devised in a spirit of insular "jingoism" and promulgated as by a lordly estate to an inferior order?

The Annual Meeting of the American Street Railway Association.

The 14th annual convention of the American Street Railway Association will be held at Montreal, Canada, opening on Tuesday, Oct. 15, and closing on Friday, Oct. 18, 1895. The officers of the Association have spared no pains to make this meeting the most interesting and profitable one ever held.

The Association has issued a pamphlet containing the rules and regulations applying to the exposition feature of the convention, as well as information concerning the shipment and handling of exhibits, which is of much importance to intending exhibitors. Copies of the pamphlet can be obtained from Mr. John A. Partridge, Secretary, Brooklyn, N. Y.

Electrical Interference.

In the discussion of a paper read before the Chicago convention of the Northwestern Electrical Association Mr. A. V. Abbott stated that there have been cases of continuous-current lighting in Germany "in which the establishment of a neighboring alternating current actually put the lamps out; that is to say, interfered to such an extent that the lighting could not be carried on. By the introduction of appropriate impedance coils the trouble was practically cured. The method of transposition accomplishes the same result, but cannot always be employed."

The Two-Carbon Arc Lamp Litigation.

Judge Showalter in the United States Circuit Court of Appeals last week handed down a decision dismissing two suits brought by the Brush Electric Company against the Western Electric Company for infringement of the Brush two-carbon arc lamp patent. It is said that the former company has paid out almost $200,000 in litigation to sustain the fundamental claims of this patent, which, moreover, have been upheld by the courts until the present decision. As, however, the patent in suit (No. 219,206) was issued Sept. 2, 1879, and, therefore, will expire in shortly over a year, the importance of the decision is largely curtailed.

The suits were for infringement of the above patent by lamps made under three patents (Nos. 418,758, 502,535 and 502,536) issued to Charles E. Scribner, the first named on Jan. 7, 1890, and the other two on Aug. 1, 1893. The opinion refers to the fact that prior to the first of the present suits, the complainant commenced a suit for an alleged infringement by lamps made under the first-named patent—the Toledo, O., suit which was decided in favor of the Brush patent—but as the present defendant was not a party to that suit, and the records before the present court contain a mass of evidence that was not before the Toledo court, the decree of that is declared not to affect the present litigation.

The opinion states that the ideas of the Brush invention in suit were apparently as follows: 1st. By separating the second pair of carbons first, he threw the entire current down the other pair, and thus determined that the arc should form between said other pair, or pair last separated. 2d. By separating the second pair at a greater distance apart than the other pair, he avoided accidental alternation in the arc between the two pairs. 3d. By permanently holding the second pair in such separated relation, the first pair could be fed together and consumed without stop.

In each of the six Brush patent claims in controversy, the action of the mechanism is described as having for an object to "separate said pairs (of carbons) dissimultaneously or successively." In the opinion of the court, the observable interval between the point of time at which the separation between the added pair of carbons takes place and the point of time at which the separation of the other pair takes place, the purpose being to determine the arc between the pair last separated—is the *dissimultaneousness* found in each of said six claims; and it is added that, with all respect for the learned writer of the opinion in the Toledo case, and for the learned counsel for complainant, the formula of words, "dissimultaneous arc-forming separation," does not carry any definite meaning. The adjectives *simultaneous* or *dissimultaneous*, are words of comparison. The former means that two or more occurrences or happenings are identical in time, the latter that they are successive—that is to say, with an interval between each two in succession. The arc-forming separation which takes place between the first pair of carbons to burn, and the arc-forming separation which takes place several hours later between the added pair of carbons, are certainly successive and, loosely speaking, dissimultaneous, but these separations lack the unity or continuity of movement implied in the term *dissimultaneous* when used in this patent. Brush coined the word "dissimultaneous" to express the momentary but observable interval—the slight but noticeable non-coincidence in time—between the separation of the added pair of carbons and the separation of the other pair in a unitary and continuous movement due to mechanism as invented by him and described in the patent in suit, in contrast with an apparently simultaneous separation due to any mechanism appropriate for the latter purpose. The conclusion reached apparently in the Toledo case, that no one of the six claims contains the element of dissimultaneous or successive separations between the members of each pair of carbons for the purpose of forming the arc between the pair last separated, seems to the court to be unsound.

The opinion continues that even if it were, in fact, immaterial which pair of carbons burned first—supposing it to be true that if the carbons were separated simultaneously instead of dissimultaneously, the lamp would still operate—the fact remains that the patentee took from the government claims in which the dissimultaneous separations are the special feature. Moreover, the feature of dissimultaneous arc-forming separations, referring here to the interval of hours between the arc-forming separation of the first pair to burn, and the arc-forming separation between the added pair, is not in any one of the claims. In order to make out a case of infringement, the former element must be gotten out of, and the latter must be gotten into, each claim. This, in the judgment of the court, cannot be done. The lamps made under the first Scribner patent do not contain mechanism constructed to cause the dissimultaneous initial separations of the carbons, nor do the lamps made under the second patent, nor do the lamps made under the third patent. The court holds, therefore, that no infringement is made out in either suit, and it is ordered that the bill be dismissed for want of equity.

English Internationalism.*

BY E. HOSPITALIER.

The reader need not fear that foreign politics will be here discussed, nor the Egyptian question, which has been provisionally settled by a "j'y suis j'y reste" which our good neighbors across the channel would like to render eternal. Our point of view will be exclusively scientific; we wish to consider English internationalism in connection with the services which it can render to the cause of uniformity of symbols, notation and physical units.

We have devoted ourselves for 12 years to this cause, which, up to the present, has developed more disappointments than successes, but if we have often encountered indifference, and at times hostility, nowhere has that hostility been as acute as in England, whose marvelous system of units is the object of compassionate admiration to all civilized peoples.

Following the Inter-Congress of Electricians held at Chicago in 1895, a table of symbols for physical quantities and abbreviations for units recommended by the committee on notations of its Chamber of Delegates was printed and distributed by THE ELECTRICAL WORLD in America and *L'Industrie Electrique* in France. The symbols spread slowly, like an oil stain, and, in time, they will establish themselves. The establishment of international symbols is not an easy matter, and it has been necessary to make a compromise by taking the initial letters of quantities as named in several different languages, and here the international character of our neighbors clearly manifests itself. They willingly accepted *P* as the symbol of *power* and *W* as the symbol of *energy* or *work*, but they do not hear of using *I* for the intensity of the current which they continue to designate by the letter *C*, and as *C* had been chosen for capacity, they replace it by the letter *K;* thus entirely destroying uniformity, in order not to change their habit on a single point.

To accept the concessions of others and make none—this is a characteristic of English internationalism. It was recently manifested in an article in the *Electrician* apropos of the symbols for magnetic quantities and the names of units provisionally adopted last year by the American Institute of Electrical Engineers. The following are the terms in which our contemporary rejects the one and the other:

"Every individual is, of course, entitled to have his own opinion as to the relative merits of 'block' and 'black' letters; but the use of 'block' letters having become well established in this country, where modern magnetism took its growth, we may be pardoned for refusing to countenance any further this anarchic tendency of every new writer on magnetic subjects to employ whatever symbols and terms seem good in his own eyes. The strange names which Messrs. Houston and Kennelly employ for the numerous magnetic units they refer to are quite unnecessary additions to the jargon of science, already sufficiently irritating, and they possess neither the sanction of authoritative nor of international usage, notwithstanding their adoption by the American Institute of Electrical Engineers. The hasty introduction of superfluous names and terms cannot be too strongly deprecated, both in the interest of science and of sense."

In its prejudice, no less excessive than national, our contemporary commits a double error, with respect both to symbols of physical quantities and units.

Magnetism has received its modern development in England. The *Electrician's* declaration to this effect lacks modesty, but it is exact, and, moreover, confirms our argument in favor of script letters. It was the papers presented at the Royal Society in 1885, by Dr. Hopkinson and Prof. Ewing, which contributed above all to this development. Now, as we write, we have before us extracts from the *Philosophical Transactions* of the Royal Society, and we find that the symbols of magnetic quantities ($\mathfrak{B}$, $\mathfrak{H}$ and $\mathfrak{J}$) are in script letters. It is from the English writings of Ewing and Hop-

*From "L'Industrie Electrique," July 10, 1895.

kinson that we borrowed the symbols which appear in the table recommended by the International Congress committee, and it is the English who to-day fight most vigorously against the employment of these script letters, similarly employed by Clark Maxwell in his celebrated treatise!

We believe we have found the reason for this hostility to a change of symbols. The script letters at the time, about 1885, the new papers on magnetism appeared, existed only in a small number of printing offices, and were replaced by black letters almost illegible, and of a mean appearance. The idea then came to an economical printer—business is business—to replace black by block letters, and the English do not wish to give up the latter. Instead of permitting such commercial considerations to govern, would it not be more creditable to render homage to Maxwell, to Ewing, to Hopkinson by adopting the script letters * and doing away with those unsightly heavy characters which so deface a type page and try the patience at the blackboard?

As to the employment of one and the same unit, the *gauss*, in order to express the strength of a magnetic field, $\mathfrak{H}$, and of magnetic induction, $\mathfrak{B}$, nothing is more natural. In the electromagnetic system these two physical quantities have the relation $\mathfrak{B} = \mu \mathfrak{H}$ based upon the fundamental hypothesis, that μ is an abstract number, a simple numerical ratio. So long as absolute dimensions are not established for magnetic permeability in terms of L, M and T, it will be logical and rational to measure $\mathfrak{H}$ and $\mathfrak{C}$ by a single unit, as the centimetre is employed to measure lengths, breadths, heights, thicknesses and self-inductances in the electromagnetic, and capacities in the electrostatic, system. In all of the works of Lord Kelvin —an indisputable authority in England as in the entire world—are not resistances expressed in centimetres per second? Does not Dr. Hopkinson express couples (torque) in joules in his writings on tramways? Lord Kelvin very well knows, however, that a resistance is not a velocity, and Dr. Hopkinson is aware that couple is not work. They employ, nevertheless, these units, and with reason, because they result from hypotheses made to establish as coherent and simple a system as possible, and which follows naturally from these hypotheses. The day when a more advanced stage of science will permit the suppression of these hypotheses and the establishment of absolute dimensions for physical quantities, then and then only will it be necessary to again commence to create new names in large numbers, since it will no longer be legitimate to measure with the same unit two quantities not having the same dimensions. But in the actual state of the science, and with the fundamental hypothesis which serves as a base for the electromagnetic system—a hypothesis which makes magnetic permeability a simple numerical ratio—it is coherent, logical and rational to measure $\mathfrak{B}$ and $\mathfrak{H}$ with a single and the same unit. This is more rational and logical than to express, as our contemporary often does, resistivities in ohms per cubic centimeter, a resistivity being neither a resistance nor the quotient of a resistance by a volume.

As to the utility of the names which the *Electrician* puts in doubt, we would observe that they are most useful, and that in teaching, at least, the names are of the most particular service. They have the advantage of adding the concrete to the idea of the quantity measured, its nature being indicated merely by the announcement of the name of the unit in which its measurement is expressed.

As to the reproach that the magnetic units have not the sanction of international usage, that is a mere quibble, as the units are yet scarcely a year old. The systematic hostility of the *Electrician* will not contribute to their extension, which, nevertheless, will proceed, the metric system similarly having become generally adopted throughout the entire world, notwithstanding England.

But of this question of symbols it does not displease us to see the English after an interval of ten years denying their scientific gods in order to avoid incurring expense for new printing characters. Que penses-tu de tes compatriotes, O ombre de Maxwell?

* Below the four symbols most employed in magnetism are given in the different characters still in use:

Italic capitals.....	*B*	*H*	*I*	*R*
Script letters.....	$\mathfrak{B}$	$\mathfrak{H}$	$\mathfrak{I}$	$\mathfrak{R}$
Block letters.....	𝗕	𝗛	𝗜	𝗥
Black letters.....	𝔅	𝔊	𝔍	𝔎

This table shows that the black letters are neither legible nor easy to write; the block letters are too heavy (it is proposed to reserve them for photometric quantities, which are little used); and the italic capitals are in part employed for other quantities. The script letters, therefore, are specially suitable to magnetism.

Heating Tests of Insulation.

Prof. W. L. Puffer at the May meeting of the American Institute of Electrical Engineers gave the results of some experiments made at the Massachusetts Institute of Technology on a large number of samples of wires, the object being to find out what strength of current passing through the wire for from, say, 10 to 15 minutes, would raise the temperature up to certain definite points which could be readily recognized without guess work or measurement of resistance The first point was indicated by the boiling of a small drop of water placed in a small opening in the insulation. The next point was, when the slightest trace of smoke appeared. The wire was used in 5-foot lengths, 75 samples being tested. It was found that with all sorts of wires, whether with light or heavy insulation, the smoking point was identical, and no difference was noticeable between black and white covered wires.

Prof. Puffer recommends as a result of the experiments described that the safety limit should be less than 150 degrees F., as rubber begins to be injured at that point. A mathematical statement of the smoking current is that its value is 1,610 times the diameter of a wire raised to the 1.28 power. Prof. Puffer does not approve of the recent 25 per cent. increase by the Underwriters' National Electric Association in the heating limits of wire, which increase he states to be purely an arbitrary one. He believes that insurance rules ought to introduce another factor with reference to safety of life in view of the demoralization of firemen in the presence of live wires, and the suggestion is offered to thoroughly ground the secondary wire. He looks upon the grounding of the secondary as the lesser of two evils, as it lessens the insulation strain more than grounding either side, rendering it impossible not only to receive a greater shock from any part of the service than the voltage of the plant itself between the ground and wire, while the electrostatic danger element disappears entirely.

The accompanying table was prepared to give a comparison relative to the heating of conductors. Column one is taken from the published curves of Kennelly's experiments, and the values contained express, as nearly as could be taken from his curves, those currents whose double value would heat a wire up to 150 degrees F. from 75 degrees F. Column two contains the ratings as given in insurance tables previous to Jan. 10, and is an approximation to Kennelly's mathematical curve. Table three is a table of currents producing a rise of 75 degrees, or to the danger point of rubber coverings. Column four is a table of smoking points of all kinds of insulations.

B & S.	1	2	3	4
0000	180	175	360	630
000	149	145	298	519
00	123	120	246	438
0	103	100	206	372
1	86	85	172	319
2	72	70	144	273
3	60	60	120	237
4	52	50	104	207
5	45	45	90	178
6	39	35	78	155
7	34	30	68	134
8	29	25	58	127
10	23	20	46	87
12	17	15	34	65
14	13	10	25	48

To Illuminate Niagara.

Experiments have been in progress for some time at the Schenectady works of the General Electric Company, in the interests of the Michigan Central Railway Company, for the construction of search lights of sufficient power and quality to illuminate Niagara Falls.

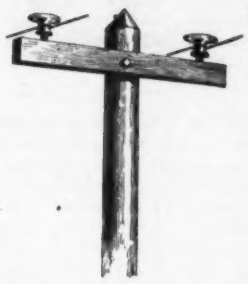
It is proposed to install two 48-inch lamps of 10,000 cp each, producing an effect similar to the illumination of the Rhine Fall at Schalthausen.

Depreciation Extraordinary.

At a recent meeting of the railway committee of the Brooklyn City Council, Secretary Swin, of the Brooklyn City Railway Company, in presenting a claim for the reduction of taxes, testified that the depreciation in the electrical equipment of the various roads controlled by his company has since the first of January, 1892, amounted to $5,000,000. The depreciation of electric street railway he stated, is fully 60 or 70 per cent. In the present instance it consisted in the natural wear and tear, the substitution of new apparatus for old and the abandonment of an entire power house which had cost $700,000.

Invention of the Electromagnetic Telegraph.—III.

BY FRANKLIN L. POPE.



THE editor of THE ELECTRICAL WORLD in making the announcement, some weeks since, of the intended publication of a series of articles relating to the authorship of the Electromagnetic Telegraph, expressed the hope that these might not only form a contribution of permanent value to telegraphic history, but that they might also definitely end a discussion which has given rise to much bitter feeling. Much as this last consummation is to be desired, I am not so sanguine as to anticipate the immediate settlement of a controversy which has now been waged for more than half a century, that shall be acceptable to any considerable number of the participants. The most that can be done at this late day is to establish with as near an approach as may be to historical accuracy the leading facts, leaving each writer to express his individual convictions in respect to the conclusions which may be drawn from such facts. There is always room for honest difference of opinion in matters of this kind, and I shall accordingly only seek to point out what shall seem to me to be necessary deductions from the facts which I propose to present. I have not the slightest personal bias in favor of or against any of the parties to the controversy, and my sole aim will be to discover and make known what shall appear to me to be the truth.

TWO GROUPS OF NOTABLE MEN.

The period of time covered by the events which form the topic of the present discussion extends from 1829, the beginning of the memorable experiments of Joseph Henry which gave us the modern electromagnet, down to the final adjudication upon Morse's patents in the Supreme Court of the United States, in 1854. In reviewing the history of this eventful quarter-century during which the electromagnetic telegraph was born, nurtured and brought to the maturity of its powers, one instantly grasps the fact that the destinies of this great agent of modern civilization were virtually in the hands of a little group of individuals, among whom, however, were numbered some of the ablest minds that our country has ever produced. It would perhaps be more accurate to say that there were two of these groups, one of discoverers, inventors and scientists, and the other of organizers, promoters and business managers. Head and shoulders above all others, in the first group we find Joseph Henry, Samuel Finley Breese Morse, Alfred Vail and Leonard D. Gale; in the second group Francis Osmond Jonathan Smith, Henry O'Reilly, Amos Kendall and Ezra Cornell. The history of these eight men, during these fateful years, is virtually the history of the electric telegraph in America. They were years of prolonged and embittered controversy, of incrimination and recrimination, of suits and counter-suits, of secret plots and open quarrels. From the vast volume of private correspondence; from the records of legal proceedings, from ephemeral pamphlets and newspaper articles, and from these only, can be gleaned the full and authentic history of the events now under discussion.

ALFRED VAIL.

The true character of a man, as well as the hidden motives of his actions, are most faithfully revealed in such of his utterances and writings as were not intended for the public eye, but were only designed to serve some immediate end in view; what others may have said of him, in the way of praise or of blame, is comparatively of little consequence. Of the eight men named above, I have personally met no others than Henry, Morse and O'Reilly, and with these my actual acquaintance was of the slightest. I have, however, from time to time been accorded the opportunity of reading hundreds of original letters which passed to and fro between them, and my extracts and memoranda therefrom throw a flood of light upon the true inner history of the period of storm and stress through which the telegraph was destined to pass before it became the great commercial and social agency which we recognize to-day. And it ought to be said in the outset, and this without disparagement of some of the others who have been named, that few men have lived whose characters compel a higher meed of admiration and praise, for integrity of purpose, considerate regard for the feelings and rights of others, and high ambition to serve the interests of their fellowmen rather than themselves, than Samuel F. B. Morse and Alfred Vail. This may seem a strange statement to make, in view of some of the circumstances of the case, but it is nevertheless made without qualification or reservation, in the full belief that the few occurrences which at first sight seem inconsistent with such a verdict are susceptible of satisfactory explanation. Most of the controversies between honest and well-intending persons in this world result from pure misunderstandings and misconceptions; sometimes arising from causes wholly accidental, but more often set on foot and fanned into a flame by the crafty malice of third parties for the better serving of their own selfish ends. The history of the telegraph is full of these plots and counterplots, the results of some of which were most lamentable, no less from a public than a private point of view. No truer words were ever penned than those of an eminent counsel* who had been prominent in connection with suits growing out of the telegraph patents when he said in 1853: "The history of telegraphing here is a history of wars, of contentions, of wasted energies, of sunken capital and blasted expectations."

THE UNITED STATES PATENT LAW AS A TEST OF INVENTION.

In order to justly apportion the credit for the invention of the American electromagnetic telegraph among the different claimants for that honor, it is probable that no better method can be adopted than to apply to the consideration of the question the principles of the *patent law* of the United States, as formulated in a long line of judicial decisions extending over a period of more than a century. The original act of 1790 granted the protection of a patent upon the petition of any person or persons who should be able to satisfy the proper officers of the government that "he, she or they, hath or have invented or discovered any useful art, manufacture, engine, machine or device, or any improvement therein, not before known or used." By the act of 1793, this provision was changed so as to read "have invented any new and useful art, machine, manufacture, or composition of matter, not known or used before the application," and this has substantially remained the fundamental law to the present time.

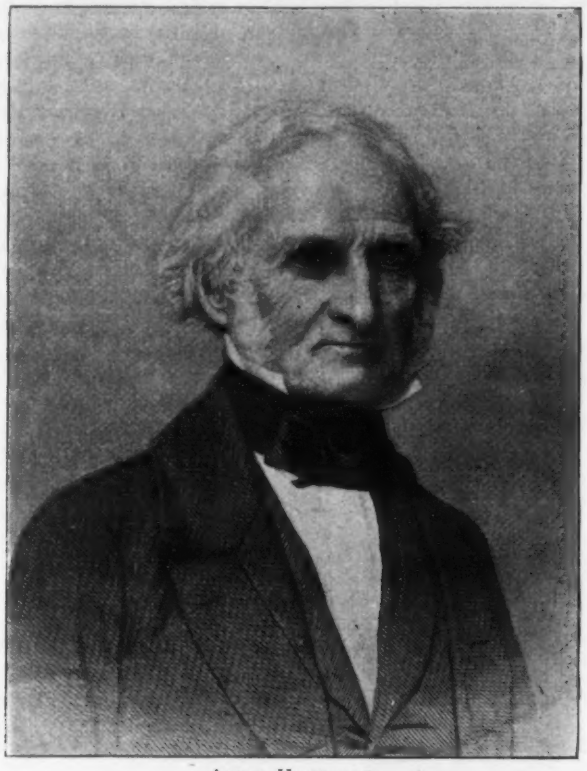
Now in view of the language of the statute, it is obvious that in order to maintain his legal right to exclusive possession of an alleged invention, the patentee must prove three things: First, that his invention *has not been known or used*; second, that it *possesses utility*; third, that it *originated with himself.* These three tests must be rigidly applied to every invention which is brought before the courts, and they have been so applied in a vast body of judicial decisions, the substance of which constitutes the patent law of to-day and doubtless of all future time. If, in the light of later knowledge, we apply these established legal principles to the work of the several inventors who have contributed to the perfection of the electric telegraph as we have it to-day, we ought to be able to reach some definite conclusions as to their respective individual merits.

EARLY SUGGESTIONS RELATIVE TO THE ELECTRIC TELEGRAPH.

The history of the telegraph has already been so fully written, that the portions of it respecting which no controversy exists may

* E. W. Chester.

be passed over with brief mention. It only needs to be premised that until the progress of science had developed the possibility of producing at a distance by means of voltaic electricity, physical

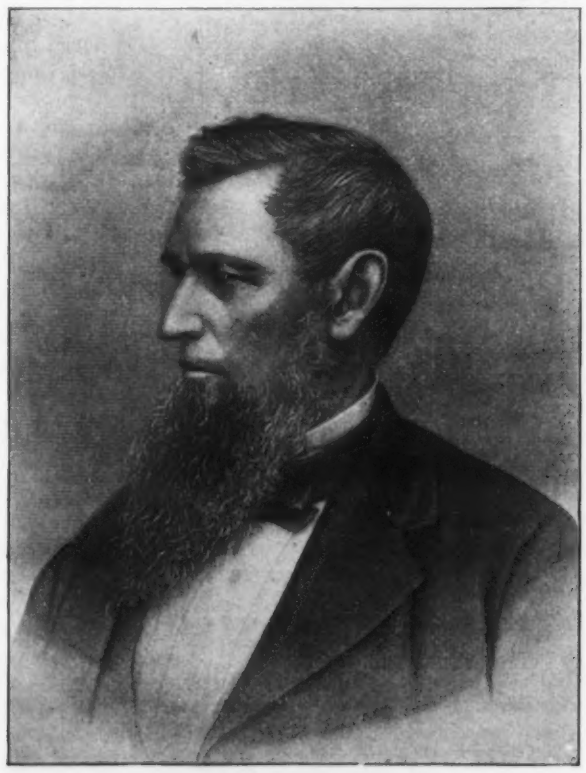


Amos Kendall.

effects capable of being appreciated by the senses, no such thing as an electric telegraph in the modern commercial sense, was even a possibility.

The earliest suggestion which appears to have any historical relation to the modern electric telegraph, is probably that of Ampère, who, in a memoir read before the Royal Academy of Sciences in Paris, Oct. 2, 1820, said:

"It is feasible by means of as many conducting wires and magnetic needles as there are letters (each letter being assigned to a



Ezra T. Cornell.

separate needle) and by the help of a battery at a distance, with its poles alternately connected with the extremity of each conductor) to establish a kind of *telegraph* adapted to transmit over intervening obstacles whatever information may be desired to the person observing the letters of the needles. A set of keys near the battery, bearing corresponding letters and making connection, would offer a facile means of correspondence."*

In 1824, Peter Barlow, an eminent English scientist of that day, undertook to put Ampère's suggestion into practice. Here is his own statement of the result:

"The details of this contrivance are so obvious, and the principle upon which it is founded so well understood, that there was only one question which could render the result doubtful; and this was: is there any diminution of effect by lengthening the conducting wire? It has been said that the electric fluid from a common electrical battery [of Leyden jars] had been transmitted through a wire four miles in length without any sensible diminution of effect, and to every appearance instantaneously; and if this should be found to be the case with the galvanic circuit, then no question could be entertained of the practicability and utility of the suggestion above adverted to. I was therefore induced to make the trial; but *I found such a sensible diminution with only 200 feet of wire, as at once to convince me of the impracticability of the scheme.*" †

Joseph Henry's Discoveries and Inventions.

In 1828 (June) Joseph Henry exhibited to the Albany Institute a small electromagnet closely wound with silk-covered copper wire about one-thirtieth of an inch in diameter. This was the first

Henry O'Reilly.

instance in which the *wire* had been coated with insulating material instead of the core, as in the electromagnets of Sturgeon and Dana. Continuing his experiments in 1830, Henry, by rewinding the coils of his small electromagnet of 1829, found that the current from a "trough" or series of cells, would produce marked magnetic effects through 1,060 feet of copper wire, provided the magnet was wound with a long continuous coil. It is difficult to overestimate the importance of this basic discovery. In his paper describing these experiments, he says:

"The fact that the magnetic action of a current from a trough is at least not sensibly diminished by passing through a long wire, *is directly applicable to Mr. Barlow's project of forming an electromagnetic telegraph.*"‡

Now it must not be forgotten that this was the discovery which for the first time rendered the electric telegraph, in a commercial sense, a possibility. Prior to this time, Barlow's results had been accepted on all sides as conclusive against its practicability. Even so late as 1843, Prof. Daniell said:

"Electromagnets of the greatest power, even when the most

* *Annales Chim. et Phys.* xv., 72-3.
† *Edin. Phil. Jour.*, xii., 105.
‡ *Sill. Jour.*, xix., 403-4.

energetic batteries are employed, utterly cease to act when they are connected by considerable lengths of wire with the battery, and the apparent hopelessness of immediately employing them for telegraphic communication induced him (Prof. Wheatstone) at first to have recourse to secondary means of bringing their attractive power into action, which was attended with many inconveniencies."*

Nor did Henry content himself with merely making a statement that his discovery was "directly applicable to the project of forming an electric telegraph"—not Barlow's project, as we have seen above, but in reality, Ampère's. Early in the year 1831, Henry, as a further and experimental demonstration of the practicability of an electric telegraph, constructed an apparatus which he describes as follows:

"I arranged around one of the upper rooms in the Albany academy a wire of more than a mile in length, through which I was enabled to make signals by sounding a bell. The mechanical arrangement for effecting this object was simply a steel bar, permanently magnetized, of about ten inches in length, supported on a pivot and placed with its north end between the two arms of a horseshoe magnet. When the latter was excited by the current, the end of the bar thus placed was attracted by one end of the horseshoe and repelled by the other, and was thus caused to move in a horizontal plane and its further extremity to strike a bell suitably adjusted."†

A quarter of a century afterward, Henry said:

"I have sought no patent for my inventions, and solicited no remuneration for my labors, but have freely given their results to the world; expecting only in return to enjoy the consciousness of having added by my investigations to the sum of human knowledge, and to receive the credit to which they might justly entitle me."‡

HENRY'S DISCOVERIES AND INVENTIONS FORMULATED.

In pursuance of the method of analysis heretofore suggested, let us suppose Henry had chosen, in 1831, to have applied for a patent for the discoveries and inventions which he had made and reduced to practice up to that time. I think it must be admitted that he was, in justice, entitled to make claims substantially as follows:

1. An electromagnet, the helices of which are composed of wire enveloped in non-conducting material.

2 An electromagnet, the helices of which are formed of two or more superposed layers of convolutions of insulated wire.

3. An electromagnet, the helices of which are composed of two or more superposed layers of convolutions of insulated wire, in combination with a battery consisting of two or more pairs of plates, arranged in series in circuit therewith.

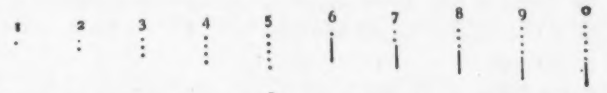
4. A battery of two or more pairs of plates arranged in series, in combination with an electromagnet having helices consisting of two or more superposed layers of convolutions of insulated wire, a movably supported armature, a resonant stop upon which said armature impinges when moved against it by the attraction of said electromagnet, means for withdrawing said armature from said stop, and means for controlling the duration or polarity, or both, of the current passing from the battery to the electromagnet.

5. The art of transmitting intelligence to a distance by the electric current, which consists in imparting motion to mechanism, by means of magnetism produced by completing an electric current at an initial point, whereby sounds may be produced at will at some other point and intelligence be thereby communicated.

MORSE'S CONCEPTION OF THE RECORDING TELEGRAPH.

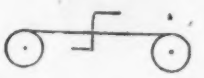
Morse conceived the idea of his telegraph on board the packet *Sully* in 1832. He had learned from the lectures of Prof. James Freeman Dana in New York, in 1827, so much as was at that date known of the sciences of voltaic electricity and electromagnetism; and he had witnessed the action of Sturgeon's magnet, with its insulated core and its single layer of turns of non-insulated wire under the influence of the voltaic current. He knew nothing in 1832, nor for years afterward, of what Henry had done at Albany the preceding year. As fast as ideas came to his mind, he jotted them down in his pocket sketch-book. James D. Reid, the historian of the telegraph, says:

"The sketches of this Atlantic journey are full of interest as aiding to indicate how the coming telegraph took its first form in Mr. Morse's mind. They are all the more so because these sketches were made at sea, far away from all possible help from books of reference, to which, had the idea sprung upon him on shore, he would naturally have had immediate recourse. Although his knowledge of electric phenomena was at this time as complete as the condition of electric discovery permitted, and that, too, more than usually exact, yet we have no evidence, although the contrary is claimed for him, that prior to this ocean voyage he had ever associated the science with any scheme for popular utility. The thought now, however, took at once that direction. His sketch-book shows this. Here is one of the earliest of these sketches. The first thought, it will be seen, is not unlike the latest. In fact, the history of the invention shows nothing which in some respects seemed to take, at its inception, more complete and abiding shape. The following are the signs he thought could be made by one of the processes referred to. These were confined to figures, which he thought could be used as the basis of a code for words and sentences:

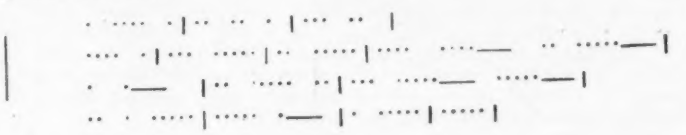


"These, of course, have all been changed in their relation to signs since then, yet all of them, except the last, are in use to-day as the representatives of other characters.

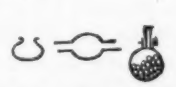
"Then follows a sketch, which is afterward more elaborated, in which the plan of obtaining a record begins to foreshadow itself. This is evidently the idea of the electrochemical process obtaining signals by the passage of the current through chemically prepared paper:



"On another page appears the following, which with the numerical signs above given, is easy of translation, and is the idea of coding messages by making numbers the signs of words. The translation appears hereafter:



"Between the lines of this sketch, the use of which is indicated afterward, appear the following diagrams of tubes, as if the whole plan, not only of the mode of transmission, but of the methods of establishing communication, were at the same time rushing through his mind.



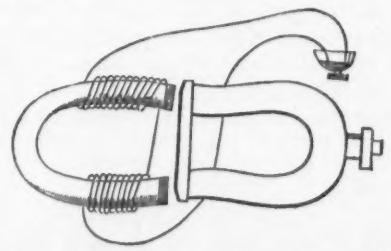
"These evidently have in view an underground arrangement of wires as the first crude thought of how they could be arranged to connect distant places, arose in his mind. Unfortunately for himself, he long adhered to the subterranean plan, and only abandoned it when ruin stared him in the face.

HE TRANSMITS INTELLIGIBLE SIGNALS BY THE ELECTROMAGNET.

"On another leaf was sketched the following code message, of which the characters already given are the signals, and to which the reader will refer for interpretation:

215	56	15	5	
War	Holland	Belgium	Alliance	
161	252	300	41	35
France	England	Against	Russia	Prussia
25	4,030	141		
Austria	Wednesday	6th August		
22	32			
Naturalist	Died			

"On another page appears the following which is evidently a method by which, by means of a battery, a bar of iron can be taken by an electromagnet from the attraction of the circuit, and thus, by reciprocal action, motion be produced. In this process the fixed magnet is used in place of the modern adjusting or retractile spring, now in common use, and which was the basis of the patent afterward granted to Prof. Page:



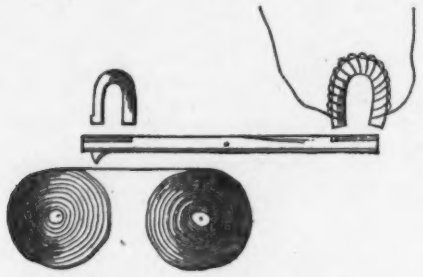
"The cup in the sketch probably represents a cell or battery, or what seems as likely, a cup of mercury, in which the ends of the wire were immersed to form a connection, omitting the battery.

"Following these appears a sketch of metal type, . . . the type rule of the automatic system of transmission, by which a conductor passing over metal teeth manipulates signals to a distant station, instead of by the hand and key, as in the common mode, and which Mr. Morse did not at first adopt, the automatic system having first engaged his thoughts. The automatic system of the present day is, indeed, simply the use of paper to indicate the spaces

* *Introduction to Chemical Philosophy*. 2d ed., p. 569.
† *Smithsonian Report*. 1857, 106, 112.
‡ *Smithsonian Report*. 1857, p. 86.

which in Morse's type rule were made by the spaces between the metallic teeth, any excellence in present modes being entirely in the mechanical devices by which the paper is prepared for transmitting, and in methods to avoid the static charge and to secure a clear and rapid record over extended circuits by the electrochemical process.

"The following is a sketch which is evidently designed to show in the rough the mode of obtaining a record. It is so simple that it is not necessary that the parts be indicated by lettering. There are the moving paper rollers, not yet put into a cog-moving machine, but sufficiently indicated to be understood. There is the marking point at the extremity of a centered bar. There is the electromagnet with its connecting wire, which, when charged,



overcomes the opposite permanent magnet, and secures contact with the rolling paper. These, indeed, are the essential features of the telegraph complete, the same as it is to-day, so far as the recording apparatus is concerned, except the change in the mode of constructing the magnet, and the spring which supersedes the permanent magnet. The latter seems to have been, as already said, the patented invention of Prof. Page, and was afterward connected with the Morse apparatus by purchase. Yet, curiously enough, the use of the spring to withdraw the armature on the opening on the circuit is referred to in one of Morse's early experiments. The expedient was a very simple and natural one."

WHAT WAS THE TRUE DATE OF MORSE'S REDUCTION TO PRACTICE?

There can be no question that the devices and methods embodied in the foregoing sketches evince an inventive talent of a very high order. The next step necessary to be taken by Morse was that which the patent law regards as the second and critical one in the history of an invention—that of *reduction to practice*. For some years the straitened circumstances of the inventor barred his further progress, and there is a conflict of evidence which has never been satisfactorily explained, as to the true date of the construction of the first actually operative machinery. Morse himself has repeatedly given the date as the latter part of 1835, and in speaking of the original instrument hereafter more particularly described, says:

"With this apparatus, rude as it was, and *completed before the first of the year 1836*, I was enabled to and did mark down intelligible telegraphic signs, and to make and did make distinguishable sounds for telegraphing."*

Prof. Leonard D. Gale in his deposition confirms the statement of Morse, in the following words:

"In the month of January, 1836, I was colleague professor in the University of the City of New York with Samuel F. B. Morse, who had rooms in the same building on Washington Square in said city. *During the said month of January* said Morse invited me to his rooms, in the said University, where I saw for the first time certain apparatus, constituting his electromagnetic telegraph."†

This date was also supported by a number of other reputable witnesses, who testified in the telegraph suits to having seen the apparatus at various times during the year 1836. On the other hand, Prof. Morse himself, in a letter written to Hon. Levi Woodbury, Secretary of the Treasury, on Sept. 27, 1837, at a time when the matter must have been much more clear in his memory than it could have been after a lapse of 15 years, says:

"The thought thus conceived took strong hold of my mind in the leisure which the voyage afforded, and I planned a system of signs and an apparatus to carry it into effect. I cast a species of type, which I had devised for this purpose the first week after my arrival home; and *although the rest of the machinery was planned*, yet from the pressure of unavoidable duties, I was compelled to postpone my experiments, *and was not able to test the whole plan until within a few weeks*. The result has realized my most sanguine expectations."‡

Without seeking to controvert the testimony of Prof. Morse and the many reputable witnesses in his behalf who testified 15 years later to the fact of the completion of his apparatus in 1836, it perhaps ought to be said that there was a reason why it was of great importance, in a legal point of view, that the date of the *reduction to practice* of Morse's invention, should if possible be carried back to 1836. On June 12, 1837, William Fothergill Cooke and Charles Wheatstone took out a patent in Great Britain (No. 7,390), for "Improvements in giving signals and sounding alarms in distant places by means of electric currents transmitted through metallic circuits." Now Morse's United States patent was taken out on June 20, 1840, upon an application filed April 7, 1838, and was therefore granted pursuant to the statute of 1836, and its amendments, then in force, which statute contains, among others, the following provision:

"Provided, however, that whenever it shall satisfactorily appear that the patentee, *at the time of making his application for the patent*, believed himself to be the first inventor or discoverer of the thing patented, the same shall not be held to be void on account of the invention or discovery or any part thereof having been before known or used in any foreign country, *it not appearing that the same or any substantial part thereof had before been patented or described in any printed publication.*"

It will at once be seen that in the hotly contested litigation of 1848-54, in which a host of persistent infringers were straining every nerve to overthrow and invalidate the patents of Morse, that it might make all the difference in the world to the patentees, whether his invention had been reduced to practice in 1836, or not until "a few weeks" prior to Sept. 27, 1837, which would almost to a certainty have been subsequent to the date of Cooke and Wheatstone's British patent of June 12, of the same year.

Such an anticipation by Cooke and Wheatstone would not of course have affected the validity of Morse's patent for his actual invention, that of recording telegraphically by electromagnetism, but it would have left his commercial rivals free to use the needle apparatus upon their lines. This would have been a serious matter, for the needle system is by no means the inefficient contrivance that American writers on telegraphy have usually assumed it to be. Under energetic and competent management it might have been developed into a most formidable rival to the Morse system of that date.

(To be continued.)

* Deposition of Morse in case of French v. Rogers, made in February, 1851. Comp'ts ev. p. 168.

† Ibid., p. 431.

‡ Vail, *Am. Electromagnetic Telegraph*, p. 70.

Lighting and Power from Railway Circuits.

In a recent publication of the Electrical Bureau of the National Board of Underwriters, at Chicago, a number of letters are printed relative to the question of using current from ground return trolley circuits for light and power purposes. Profs. Anthony, Stine, and Puffer, Messrs. J. P. Barrett and L. K. Comstock, and Messrs. Stone and Webster, Pierce and Richardson, Field and Hinchman and E. P. Roberts & Co., all express the opinion that it is a practice which should not be permitted. The principal reasons against the practice are summarized as follows:

One side of the circuit is normally grounded—that is, the current depends upon the earth or pipes or wires in the earth for part of its path. This means that but *one* accidental electrical connection between any part of the wiring of the system and a gas or water pipe or structural iron work or conducting substance of any nature in electrical connection with the earth is necessary, in order to establish current flow and a resulting "burn out" or fire. In a complete metallic circuit *two* such connections are necessary, one on each side of the circuit, before current flow can be established, and, therefore, the grounded system is considerably more than twice as hazardous as the metallic.

The wires of a trolley road being run overhead are susceptible to lightning discharges; and a line being run into a building to a motor and then into the earth, affords an easy, convenient, and oftentimes preferable path for the discharge to travel, setting fire to the property on the way.

The voltage or "pressure" used on trolley systems is sufficiently high (500 volts) to be classed as a "high potential" under the rules, and the energy used on the circuit is sufficient to necessitate the generation of large current quantities, oftentimes great enough to produce very severe heating effects. We have then the disadvantages of the series arc system in the comparatively high voltage used, which tends to break down our insulation, coupled with the disadvantage of the low potential system, which uses large currents, and this results in bringing about enormous heating effects at the point where the break occurs. This high voltage and large current is a very bad combination to properly control under the most favorable circumstances. When traveling over the uncertain

path offered by a grounded trolley system, it cannot be considered desirable or safe for introduction inside of buildings.

No arguments for "protection" of the circuits by all of the proposed remedies for the evil thus far invented can hold as long as the ground connection remains. A cross between a gas pipe, for instance, and the wire running from the motor to the ground cannot blow the fuse, since the resistance of the motor intervenes and arcing may therefore be indefinitely maintained at the point of contact. Lightning arresters, extra insulated wire run on large size glass insulators, special fuses, double mounting of the motor, grounding outside the building, a sign reading "danger," a voltage reducer and numberless other proposed safeguards, are advantageous, and each does its little to decrease the probability of trouble, but they cannot make a grounded circuit the equivalent of a metallic circuit from any point of view. The fluctuations of voltage on trolley circuits and consequent sudden increases of current flow makes proper fusing of the circuit improbable.

On the Relation Between Maximum Induction and Remanance.

BY REGINALD A. FESSENDEN.

In a recent article,* Messrs. Houston and Kennelly call attention to the fact that there appears to be a remarkably simple relation between the different values of maximum induction given to various samples of iron, and the corresponding remanances. The formula seems to hold for a variety of materials. No curves, however, were given for the behavior of soft iron at high inductions, and though, for practical purposes, this is a question of very little importance, as in general we are only concerned with the remanance of hardened steel, cast iron or soft iron at low inductions, yet, from a theoretical point of view, the question whether the law still holds good is of considerable interest.

I give, therefore, some results obtained by me from a brand of iron used by several large manufacturers of transformers:

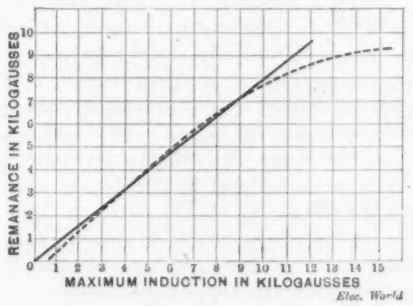
$\mathfrak{H}_{max}$	$\mathfrak{B}_{max}$	$\mathfrak{R}$	$\mathfrak{B}_{rem}$
1.1	2910	.0003962	.002156
2.52	6960	3617	5753
4.12	9170	4496	7205
5.44	10490	5188	7964
11.55	13200	8749	8799
16.33	14200	11635	8998
21.48	15340	14000	9283

(As with all other brands of soft iron and steel tested by the writer, the $\mathfrak{R}$—$\mathfrak{H}$ curve is a straight line. The equation for this brand is, $\rho = .000213 + .00005605\mathfrak{H}$, for all values of $\mathfrak{H}$ above 1 or 2.)

The curve showing the relation between maximum induction and remanance is given in the accompanying cut. It will be seen that up to values of $\mathfrak{B} = 10$ kilogausses, the remanance is very fairly represented by the equation

$$\text{Remanance} = .8\ (\mathfrak{B}_{max} - 200.)$$

and thus far Messrs. Houston and Kennelly's results are confirmed.



Above that induction, however, the line drops, and the equation no longer holds, thus showing an important difference in the behavior of soft iron and steel when comparatively high values of $\mathfrak{H}$ are reached. For all practical purposes, however, it would appear that the rule may be taken as correct, as we are not concerned with the remanance of soft iron under such conditions.

Behind the Times.

According to our contemporary, *Engineering News*, New York still has nearly 100 miles of street railways operated by 6,000 horses.

* THE ELECTRICAL WORLD, June 1, 1895.

Hysteresis, Frictional and Eddy-Current Losses in Continuous-Current Dynamos.*

BY GEORGE ADAMS.

The simple method of determining hysteresis, frictional and eddy-current losses, originated by Mr. Gisbert Kapp, is probably well known to most electrical engineers.

The method may be briefly stated as follows: Run the dynamo as a motor, exciting the field from a separate source, and keeping the excitation constant. The speed of the motor may be varied by varying the voltage of the current supplied to the armature. The current required to run the armature light is so small that the armature reaction may be neglected, and also its resistance. The measured voltage at the brushes may therefore be considered equal to the armature E. M. F. Take readings of speed (S), current (C), and voltage (e). By increasing the voltage we increase the readings. Plot the current readings as a function of the speed. Thus at B (Fig. 1) make $B\ F$ equal to the current at speed $O\ B$. At any other speed D plot the corresponding current $D\ E$. Join the points $F\ E$, and produce the line backward until it cuts the vertical axis at A. Then $O\ A = C_m$ represents the current at zero speed. The resistance due to hysteresis and friction is independent of the speed of the armature when once in motion, therefore we may consider the current C made up of two parts, namely, C_m required to produce the torque which just balances the resistance due to mechanical friction and magnetic hysteresis, and $C - C_m = C_e$ required to produce the torque which balances the resistance of eddy currents.

If W_m = loss in watts due to mechanical friction and hysteresis,

W_e = loss due to eddy currents.

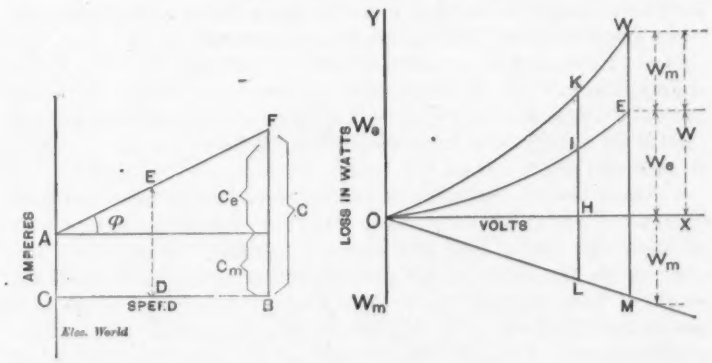
We have the total measured loss:

$$W = W_m + W_e,$$
$$W = e\ C,$$
$$W_m = e\ C_m,$$
$$W_e = e\ (C - C_m).$$

We are thus able to determine by means of a simple experiment the eddy current, and frictional and hysteresis losses when the machine is on *open circuit*.

For the same strength of field the hysteresis loss is proportional to the speed, and the same holds good for the frictional losses, provided the speed be not reduced too much. The eddy current losses being proportional to the square of the E. M. Fs. producing them, must for the same strength of field be proportional to the square of the speed. A diagram showing at a glance the relation between speed, volts, current and watts lost in hysteresis, friction and eddy currents, for a given dynamo, may be constructed as follows:

Let the abscissæ represent the volt readings, or speed of machine, and the ordinates represent losses in watts. The abscissæ in Fig.



1 will to a suitable scale represent the volt readings, and we have the relation $\frac{C_e}{e} = \tan \phi$, ϕ being the angle included between the lines $A\ C$ and $A\ F$ in Fig. 1. Also $W_e = e\ C_e = e^2 \tan \phi$. Now, $\tan \phi$ is a constant which can be obtained from the readings taken of current and volts, and is, in fact, equal to $\frac{C - C_m}{e}$. Having experimentally determined the numerical value of $\tan \phi$, we can construct the curve $O\ E$ (Fig. 2), from the equation $W_e = e\ C_e = e^2 \tan \phi$. The curve $O\ E$ is a parabola having its axis at $O\ Y$.

* From the London *Electrician*, July 5, 1895.

Now, $W_m = e\,C_m$, and C_m is found by the construction, Fig. 1, or it may be obtained at once from the following formula:

$$C_m = \frac{S\,C_1 - S_1\,C}{S - S_1},$$

where S = speed corresponding to current reading C, S_1 = speed corresponding to current reading C_1. S should be about normal speed, and S_1 about half speed.

Next plot the value of W_m corresponding to any volt reading, and draw a line from this point through the origin O. Since the loss by friction and hysteresis varies as the speed, the ordinates of the line $O\,M$ thus found will represent the watts lost in hysteresis and friction for the voltage represented by the corresponding abscissæ. If a curve $O\,W$ be constructed by plotting the ordinates of the line $O\,M$, such as $H\,L$ above the ordinates of the curve $O\,E$, and joining all the points thus obtained, the ordinates of the curve $O\,W$ will represent the total loss in watts, including frictional, hysteresis and eddy-current losses, the abscissæ being either volts or speeds corresponding to the volt readings. The ordinates of the curve $O\,E$ represent eddy-current losses.

The Choice of Transformers.*

BY D. C. JACKSON.

In order to obtain independent data representing all the American transformers of moderate capacities a long and carefully carried out series of tests was made by Mr. A. H. Ford in the laboratory of the University of Wisconsin. For these tests, transformers of 1,500 watts capacity, as nearly as possible, were procured directly from the manufacturers within about a year, so that the tests may be presumed to represent the latest and best designs which are now supplied. These transformers are from the most prominent makers and, in fact, include all important makes of American transformers with two or three exceptions. The results of the tests are given in Table I.

TABLE I.

Number.	Watts capacity.	Open circuit current.		Watts iron loss.		Watts copper loss full load	Total pressure drop.	Efficiency, full load.		Efficiency, all day.	
		F = 125	F = 60	F = 125	F = 60			F = 125	F = 60	F = 125	F = 60
1	1250	.043	.066	37	48	30	2.5	95	94	85	83
2	1500	.076	.124	50	71	45	3.5	95	94	85	81
3	1500	.052	.100	32	46	38	4.0	96	95	89	85
4	2500	.230	.540	135	230	44	2.5	92	89	77	68
5	1800	.076	.600	53	109	67	5.0	94	92	85	75
6	2000	.055	.091	42	56	55	5.0	95	94	89	86
7	1000	.028	.064	24	28	33	3.0	95	94	87	86
8	1500	.073	.113	57	76	31	2.5	94	93	83	79
9	1500	.077	.144	43	55	38	3.0	95	95	86	84

The data for each transformer is given for tests upon two frequencies—125 and 60 periods per second, respectively. Efficiencies have been calculated and are given in the table for each transformer when operated upon each frequency continuously at full load, and also when operated at an assumed load, which may be taken as an approximation to the average load found on good stations operating 24 hours. The latter are called "all day" efficiencies and are calculated as though the transformers ran 19 hours out of the 24 on no load and five hours on full load.

A comparison of the losses of the different transformers and their efficiencies shows in most cases that the transformers with the smallest iron losses give the highest "all day" efficiencies. The effect of the iron loss on the working efficiency depends upon the length of time the plant runs. The waste of power due to the iron loss in the transformer, continues as long as current is fed to the primary circuit, consequently, a plant which only runs six hours per day will only waste one quarter of the power by the iron loss of its transformer that it would if operated 24 hours per day. The actual number of watt-hours used by the customers of the plant might not differ very greatly in the two cases, yet the output of the station when run 24 hours might be much greater than when run six; the former difference being due to the difference in the amount of power wasted in the transformers. It is therefore evident that extreme care in the selection of the best transformers to be used on an alternating plant which runs all day may be of the greatest advantage. The lower the frequency of the alternating current which is used, the greater are the returns coming from this case likely to be.

*A paper, slightly condensed, read at the Chicago Convention of the Northwestern Electrical Association.

Let us compare transformers numbers three and four as given in the table, both being made by well-known manufacturers. The copper losses at full load do not differ very much, but the iron losses, which go on regardless of the load as long as current flows in the primary winding, differ very greatly even if we take three fifths of the loss in number four as the losses of a 1,500-watt transformer of that type. Let us suppose that these transformers are placed on a plant which supplies current 24 hours each week day and 12 hours on Sunday, which makes a total of 8,136 hours per year that current would flow in the primary winding of the transformers; then the total number of watt-hours wasted by the two transformers is as follows:

	F = 125	F = 60
Transformer 163	$8{,}136 \times 32 = 262{,}000$	$8{,}136 \times 46 = 374{,}300$
Transformer 164	$8{,}136 \times 80 = 651{,}000$	$8{,}136 \times 140 = 1{,}140{,}000$

In a station which turns out a kilowatt-hour for each eight pounds of coal burned (and this in Wisconsin requires the station to be well arranged and using coal that costs $2 50 or less) transformer No. 4 requires the buying of about a ton and a half of extra coal every year when operated at a frequency of 125; it therefore costs, other things being equal, upward of $4 per year more to operate it than No. 3. It would therefore pay well, if other things were equal, to buy transformer No. 3, even if its first cost were many dollars greater than that of No. 4. The difference between the transformers is even greater when the frequency is 60.

For every 100 transformers of the types here compared, the generator plant that supplies current to No. 4 must be of five kilowatts greater capacity than that required for No. 3, which means an increase of three per cent. in the generating plant.

The difference between these two transformers is largely due to differences in the relative amounts and arrangement of the iron and copper in the cores and windings and the magnetic quality of the iron ore. The standing of the manufacturers renders it probable that the transformers are of equal durability and reliability, but the regulation of No. 4 is better. The regulation question, which should be carefully considered, makes a serious deduction from the claims of No. 3 to first place in the comparison.

Differences sometimes occur between transformers of the same size and same make which are not as great as the differences here shown to exist between Nos. 3 and 4, but are sufficiently great to seriously affect their economy. In order to husband the capacity of a plant and to save in operating expenses, it is therefore of importance not only to test transformers of different makes which are presented for sale, but to test each transformer which is put on the line. This may be easily and expeditiously done. To find the iron losses, the secondary coil of a transformer should be connected to the regular lighting circuits with an ordinary wattmeter included, and the circuit of the primary coil should be left open; the reading of the wattmeter then shows the number of watts which are wasted by the iron loss. It is needless to say that instruments which are used in such tests as are here proposed, must be fairly reliable.

To test the copper losses in a transformer, the quickest and easiest method, which is approximately accurate, is to connect the primary coil of the transformer in series with some resistance (iron wire or lamps) to the alternating incandescent circuit, and short circuit the secondary coil of the transformer through an ampere meter. The resistance should be adjusted until the full load current of the transformer flows through the ampere meter. The reading of a wattmeter so connected in circuit with the primary gives the copper loss approximately.

The drop in pressure in a transformer may be measured by connecting the transformer to the lighting circuits and reading the primary and secondary pressures by voltmeter. The transformer may then be loaded by lamps and the pressures again read when the drop is at once seen. One voltmeter may be used for this, but two are more convenient.

TABLE II.

Watts capacity.	Leakage current.
1,000	.055
2 000	.080
6 500	.100
17,500	.200

For the testing of individual transformers as they are delivered and before they are put on the lines, all the instruments which are required are already in the possession of the electric stations with the exception of a wattmeter, and this is not a serious deficiency since, if necessary, a Thomson recording wattmeter may be used instead. The testing need take but little time and is likely to result, in average stations, in the saving of considerable wastes.

For guidance in selecting transformers, Table II., compiled from data determined by Prof. Ryan, is given. The table gives the largest currents which should flow in the 1,000-volt primary of good transformers when the secondary circuits are open.

TABLE III.

Watts capacity.	Iron loss.
1,000	30
1,500	40
2,000	50
2,500	60
4 000	80
6,500	100
17,500	150

The values of the iron loss which should not be exceeded in thoroughly good transformers, are given in Table III.

The copper losses in transformers of all sizes should never exceed three and a half per cent. at full load, and ought to be between one and a half and two and a half per cent. The total drop in secondary pressure due to loading a transformer, if the primary pressure is kept constant, ought not to exceed three and a half per cent.

Magnetic Units.

At last year's meeting of the British Association, Prof. Oliver Lodge, at the request of the Electrical Standards Committee, undertook to draft for future discussion a paper on magnetic units. This paper is now being circulated among the members of the committee, and with a view to obtaining opinions on this subject from those who are not members it is reported by the London *Electrician*.

The paper in opening lays down the following conditions:

1.—That the unit of self-inductance, though frequently useful, is by no means one of the most fundamental units, but should be defined in a suitable subordinate manner, with reference to other and more important quantities. 2.—That it would be a mistake to so define it as to discourage the employment of the same term for as many other quantities of the same dimensions as possible; especially for the unit of mutual-inductance and for the unit of permeance. 3.—That the essentially different quantities commonly called $\mathfrak{H}$ and $\mathfrak{C}$ should be carefully kept distinct, although their measures in air have been conventionally so arranged as to be numerically equal.

The paper suggests that the first quantity requiring a name is that of magnetic potential, sometimes called magnetomotive force; a quantity spoken of and measured, not inconveniently, but with insufficient generality, by electrical engineers as ampere-turns. The paper apparently favors the name of *gaussage* for this quantity, and that its C. G. S. unit be one *gauss*. This "gaussage or gauss-fall," is measured by the induction through a long, narrow tube, divided by the permeance of that tube, but is frequently calculable from the ampere-turns to which it is due.

Intensity of magnetic force or $\mathfrak{H}$, the paper states, will be naturally measured by the "gauss-fall" per centimetre or the "gauss gradient." It is recommended that $\mathfrak{H}$ should not (strictly speaking) be expressed as so many lines per square centimetre, which mode of expression should be reserved for induction density, $\mathfrak{B}$. In another part of the paper, it is stated, that the true expression for $\mathfrak{C}$ is $\mathfrak{B} = \mu_0 \mathfrak{H} + (\mu - \mu_0)\mathfrak{H}$; which, although algebraically only a roundabout method of writing $\mathfrak{B} = \mu \mathfrak{H}$, is yet convenient as exhibiting separately the part of the induction due to the ether and the part due to the material medium. Intensity of magnetic force, or $\mathfrak{H}$ will, it is stated, be naturally expressed as one gauss-fall per centimetre, or the *gauss-gradient*.

The second quantity which is thought to require a name is the total induction in the magnetic circuit, also called "total flux," "total lines," etc., and it is proposed that this unit should be called a *weber* and defined as equal to 10^8 C. G. S. lines. If the induction through any weber changes at the rate of one weber per second the E. M. F. excited in that circuit is one volt. In the case of a wire circuit in which induction is varying at the rate of a weber per second, one volt is excited in each turn of the wire.

No name is assigned to induction density or $\mathfrak{B}$, which, it is stated, may be expressed as so many webers per unit area, say, per square centimetre or per square inch, or whatever is preferred for practical purposes.

The third quantity for whose unit it is thought a name is desirable, is some form of ratio between the two fundamental quantities whose units in the paper are named after Weber and Gauss, respectively. It is added, that, "It has been practically decided in America that this unit shall be named after Prof. Henry, of Washington, but the precise definition has not yet been agreed upon," this statement being the only one in the paper which implies the existence of any non-English science, the work of the Chicago International Congress, the adoption of the henry by the Congress of the United States with an exact definition, and the work of the American Institute of Electrical Engineers being ignored. Dr. Lodge believes that there are two quantities of the same physical dimensions to which the name is applicable—the self or mutual-inductance of a coil or coils of wire and the permeance or inverse reluctivity of a magnetic circuit. He thinks that the most logical order is to define permeance first as the ratio of the webers of induction to the existing gaussage and then to say that a coil of n turns of wire is n^2 or $4\pi n^2$ or $0.4\pi n^2$ times the permeance of the magnetic circuit which it embraces according to the units of gaussage and current which have been decided upon. If the units of gaussage and current are both the C. G. S. units $4\pi n^2$ is the numerical factor connecting inductance with permeance. If the C. G. S. unit of gaussage is adopted along with the ampere current, then $0.4\pi n^2$ is the factor. But if the circulation of $\mathfrak{H}$ due to *one ampere turn* is adopted as the practical usage of gaussage then n^2 is the factor; and the permeance of a cylinder instead of being simply $\frac{\mu A}{l}$ is $\frac{4\pi\mu A}{10\, l}$. It is stated that the apparent simplicity of this last system has much to recommend it for commercial use, though it will complicate the specification not only of permeance, but also of magnetic fields and potentials; but *some* inconvenience, due to the unfortunate definition of the unit pole, and the only less unfortunate definition of the practical unit of current, cannot be avoided, and the aim must be to place the inconvenience where least likely to be felt in everyday work.

Prof. Lodge states that it would be convenient if unit magnetic potential could likewise be named, since electrical engineers have shown that they have need of some such unit for the exciting cause of induction, by their practical employment of the phrase "ampere-turns." The introduction of a gauss unit in some form not too obviously limited to the case of a wire wound coil, would assist teaching and would clarify magnetic ideas. He does not, however, presume to decide between the two alternative systems of defining the gauss suggested, that is, by the C. G. S. unit on the one hand and by the ampere-turn on the other.

Dr. P. J. Gibbons Anticipated.

To the Editor of The Electrical World:

SIR:—I would ask the privilege of a few lines of space in your valuable sheet, apropos of Dr. P. J. Gibbons' claims as a discoverer. There are in all ages men who are termed fools and cranks—men who are ahead of the world of thought, born too soon. Fulton, Morse, Ericcson, and many others—we all are familiar with their struggles. Then, too, it is not unusual for two great minds to think out the same thing. Bell and Gray furnish an example. Circumstances bring one man to the front while an equally meritorious individual, who is justly entitled to fame, is left in shadow, and his name is only known to posterity through the medium of a tumble-down slab in a country churchyard.

Dr. Gibbons is not ahead in his prophesy as to liquid electricity. Jersey lightning, so I am informed, has existed in some of the Eastern States many years, and Franklin, in his letters, warns his correspondents against it.

But what I desire to place on record is a claim to priority in the name of a rusty-haired son of Erin whom I knew when I was a farmer's boy on Cattaraugus Creek. When, in the course of a January thaw, an enterprising biddy hid a nest in the hay-mow, and undertook to raise some extra early spring chickens, she brought off a fine lot of little ones, but the weather changed, and the next morning I heard the old man, who was proverbial for his prophesies and occult wisdom, say in very positive tones, when asked by his spouse about the hen's family, "frozen to death by lightning." I want the name of this man, who was a lineal descendant of the immortal "Kiss me, Hardy," and bore the same name, to be known as the original Dr. Jacobs of the cold electricity theory.

BUFFALO, N. Y. A READER.

A Difference Between Theory and Practice.

A spectrum analysis made by a German scientist shows that the incandescent gas light, which appears green, is decidedly red when compared with sunlight. It will be difficult to make the butcher believe this, who had the incandescent gas light introduced into his shop and found that the ghastly green light made his meat look so old, stale and very dead that he lost his customers.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

Note.—Typewritten copies of any of the articles referred to in the Digest, will be furnished at the rate of 5 cents per 100 words for English matter, and 8 cents per 100 words for matter in foreign languages; translations at the rate of 40 cents per 100 words. Copies of any of the journals may be ordered; address Branch Office, ELECTRICAL WORLD, No. 927 Chestnut Street, Philadelphia, Pa.

DYNAMOS, MOTORS AND TRANSFORMERS.

High-Tension Continuous-Current Laboratory Dynamo.—A well illustrated, detailed description containing data, concerning a Cail-Helmer dynamo for laboratory purposes, is published in "L'Ind. Elec.," July 10. The complete machine generates 0.2 amperes at 3,000 volts; it consists of two machines each having two large Gramme armatures and a common field; each armature generates 750 volts; the output is 600 watts and by variously coupling the armatures the voltage may be made 750, 1,500 or 3,000 with corresponding currents of 0.8, 0.4 and 0.2 amperes; the armature contains 160 coils each of 66 windings making a total of 10,560 wires on the periphery of the armature, the wire being 0.3 mm in diameter; the commutator has a diameter of eight inches and contains 160 sections making a difference of 10 volts between the two sections; the field is separately excited from a lighting circuit of 110 volts; the speed is 1,500 revolutions and the excitation requires 3,000 ampere-turns per field; the resistance of each of the armatures is 128 ohms representing a loss of 5.12 watts; the mean induction in the armature is 12,150 gausses; the hysteresis loss is 28.66 watts, and that due to the Foucault currents about the same; the cooling surface corresponds to about 24.2 square cm per watt and there is, therefore, practically no heating; the machine has given 1.5 amperes at 3,000 volts; it has also given 4,000 volts at 1,087 revolutions with an exciting current of three amperes.

Armature Cross Turns in Continuous-Current Dynamos and Their Effects.—An article by Mr. Adams is begun in the Lond. "Elec. Rev.," July 12. The distribution of magnetic lines in the air gaps is dependent on the ratio of the ampere-turns of the field magnet and the exciting power of the armature cross-turns; sparkless commutation is in a great measure dependent on the proper proportioning of these quantities; he discusses these armature cross-turns giving formulæ relative to them and points out that probably nine tenths of the cross ampere-turns will be required to drive the lines through the air gap and the remaining one tenth for the iron path, and he is therefore justified in neglecting the influence of the iron path, and in considering only what takes place in the air gap. He shows that the conductors on the armature might be replaced by a shield of copper of equal cross-section, so far as their magnetizing effect is concerned; the current in this would be the same as that in the separate wires; the deductions which he makes from this will probably be described in the next installment.

Magnetic Field of a Diphase Motor.—An article by Mr. Hanappe, giving a detailed discussion of the field of a Brown diphase motor of 5 hp, is begun in "L'Eclairage Elec.," July 6; it does not admit of being abstracted.

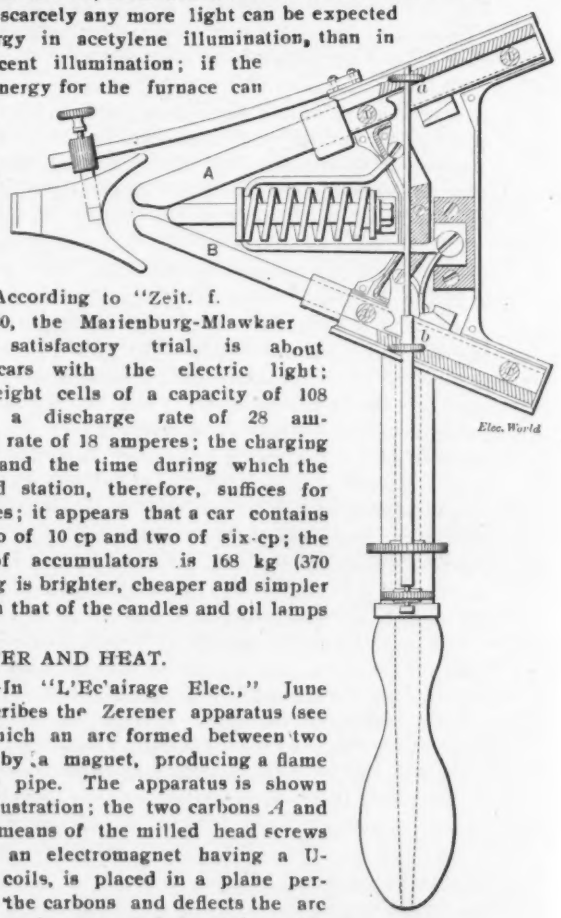
Theory of the Synchronous Motor.—The Physical Society paper by Mr. Rhodes, which was noticed in the Digest, May 25, is published in full in the "Phil. Mag." for July; it is mathematical in character and is not long.

Multiple-Current Dynamos.—The article from the Lond. "Elec. Rev.," June 28, which was abstracted in the Digest, July 20, is reprinted in full in "El'ty," July 24.

LIGHTS AND LIGHTING.

Acetylene.—Mr. Moissan in the "Rev. Gen. des Science," June 20, states that Mr. Willson's American patent dates Feb. 21, 1893, while Mr. Moissan's first research with reverberatory furnaces was published in the "Comptes Rendus," Dec. 12, 1892; he furthermore believes that a statement of Willson that sufficient carbon should be added to prevent the formation of a molten bath, invalidates his invention because the formation of calcic carbide in the electric furnace is not an electrolytic process, but purely one of fusion, a discovery which Willson made since then and prior to his German patent; in March, 1892, Moissan published a note in which he gave the results of the complete study of the preparation, physical properties and chemical composition of calcium carbide. The Lond. "Elec. Rev.," in commenting on this question editorially expresses the belief that it appears to be out of the question to use acetylene in the pure form as an illuminant as the gas is poisonous in that condition and therefore not adapted for domestic lighting; it forms explosive compounds with brass and copper pipes and therefore all these fittings would have to be dispensed with; the only practical way to use it for house illumination is to mix it with air or use it as an enricher of poor gas, but to compete successfully in this respect with naphtha, acetylene must be produced at $15 per ton. To supply gas mixed with air seems to be particularly dangerous; with 1.25 times its volume of air it is slightly explosive, with 12 volumes its explosive violence is a maximum and with 20 volumes it ceases to be explosive; acetylene produced in this way does not appear to promise any great economy over other processes in use for the same purpose.

Acetylene and Calcium Carbide.—The "Zeit. f. Beleucht.," June 15, contains a short article by Mr. Steinmetz on these materials. The following, referring to the question of the competition with the electric light, may be of interest. In obtaining comparative figures it is not right to assume the same cost for the electrical energy used in the furnace, as that for current used for lighting; the latter is several times as much as the cost of electrical energy for electrometallurgy; he adds the well-known reasons for this, all of which are favorable to using electrical energy for furnaces. He calculates theoretically the amount of energy required in the formation of calcium carbide and finds that the theoretical minimum is 0.94 kw-hours for 1 kg of calcium carbide; the latter will yield 350 litres of acetylene corresponding to 700 candle-hours; it follows that a kw-hour of electrical energy corresponds theoretically to about 750 candles or more than twice as great as by direct conversion in the incandescent light; in practice, however, a very much larger amount than the theoretical figure given above, is required for the production of calcium carbide, from which it follows that even in the most favorable cases scarcely any more light can be expected per kilowatt of energy in acetylene illumination, than in the direct incandescent illumination; if the cost of electrical energy for the furnace can be reduced to one tenth of that used for direct lighting acetylene will become a serious rival of electric and gas illumination.



Train Lighting.—According to "Zeit. f. Beleucht.," June 30, the Marienburg-Mlawkaer railroad, after a satisfactory trial, is about to equip all its cars with the electric light; each car contains eight cells of a capacity of 108 ampere-hours with a discharge rate of 28 amperes and a charging rate of 18 amperes; the charging requires six hours and the time during which the cars are at the end station, therefore, suffices for charging the batteries; it appears that a car contains one 16 cp lamp, two of 10 cp and two of six cp; the weight of a set of accumulators is 168 kg (370 pounds); the lighting is brighter, cheaper and simpler in manipulation, than that of the candles and oil lamps formerly used.

POWER AND HEAT.

Electric Welding.—In "L'Eclairage Elec.," June 29, Mr. Tabourey describes the Zerener apparatus (see Digest, July 6), in which an arc formed between two carbons is deflected by a magnet, producing a flame like that of a blow pipe. The apparatus is shown in the adjoining illustration; the two carbons *A* and *B* can be moved by means of the milled head screws near the handle; an electromagnet having a U-shaped core and two coils, is placed in a plane perpendicular to that of the carbons and deflects the arc outward; this magnet is connected in series with the arc; if a suitable block of copper is placed opposite the arc, as shown, it enables the apparatus to be used as a regular soldering iron; the current required is 30 amperes at 55 volts; a somewhat larger apparatus requiring 60 amperes is suitable for brazing the tubes in the manufacture of bicycles in less than two minutes; with this apparatus brazing of iron can be carried out very readily, as also welding of copper, by using a flux of borax mixed with chloride of zinc; very good welds have also been made with aluminum for welding iron; the arc

is regulated automatically by clockwork and the magnet is connected in parallel; the current required is 150 to 200 amperes to 65 to 70 volts; such welds are made by placing the two pieces of iron near together, inserting fragments of the metal between their ends and fusing the masses together; an experienced workman can make a weld 1 m long and 4 mm in thickness in 25 minutes with a current of 170 amperes. Among the advantages of the process are the economy of energy; it is adaptable to all forms and dimensions of the pieces and there is no burning or oxidation of the metals as in the Bernados process.

Electric Welding.—Good illustrations of a number of American electric welding machines are given in "L'Eclairage Elec.," July 6.

Transmission Plant at Neufchatel.—"L'Ind. Elec.," July 10, gives an illustrated description by Mr. Ritter including complete diagrams of the switchboard connections, of a 1,200-hp plant under construction for transmitting light and power to a distance of about six miles; single-phase alternating currents will be used for lighting and three-phase currents for power purposes, the two circuits being completely separate; the voltage will be 4,000; the lines are overhead except where they pass through the cities; motors for more than 100 hp are connected directly to the high-tension lines while the currents for the smaller are transformed down; motors above 50 hp will be synchronous, smaller ones will be non-synchronous, while those below 4 hp will be non-synchronous and connected to the secondary lighting circuit.

Two-Phase Plant.—An illustrated description of the plant at the works of Messrs. Weyher & Richmond is published in the Lond. "Elec.," July 5; descriptions of this plant have been referred to a number of times, but we believe this is the first that has been published in English.

Revolving Bridge.—According to the Lond. "Elec. Eng.," July 12, Mr. Devic proposes to construct, for the Paris exhibition of 1900, a revolving bridge over the Seine operated by electricity, which in principle is somewhat similar to the moving sidewalks at the World's Fair. There is to be one central pier on which will be pivoted a large platform 150 feet in diameter extending to the two banks; the tower in the middle would contain cafes and restaurants; it is supported on a pivot in the middle and it would be revolved by means of 24 friction rollers on the shores, operated by electric motors; the rotation of the platform would be sufficiently slow to enable passengers to step on and off without any trouble or danger.

Canadian Water Power Schemes.—The "Elec. Eng.," July 24, gives brief descriptions of three contemplated schemes; the first, that of the Welland Power & Supply Company, whose charter permits them to draw unlimited water from the Niagara River, contemplates leading the water through a channel to the mouth of the Welland River, four or five miles distant; "on the mountain top at Thorold it is proposed to build a lateral canal long enough to feed 60 turbines each of 5,000 hp"; it will make it possible to deliver power at Ft. Erie, Ont., at the very door of Buffalo, for $6 per horse-power per annum. The second plan is to utilize the water-power on the Humber River amounting to 68,595 hp for 10 hours daily. The third is to utilize the Lachine Rapids about five miles above Montreal; a drop of eight feet can be obtained developing 7,920 hp in 66 turbines.

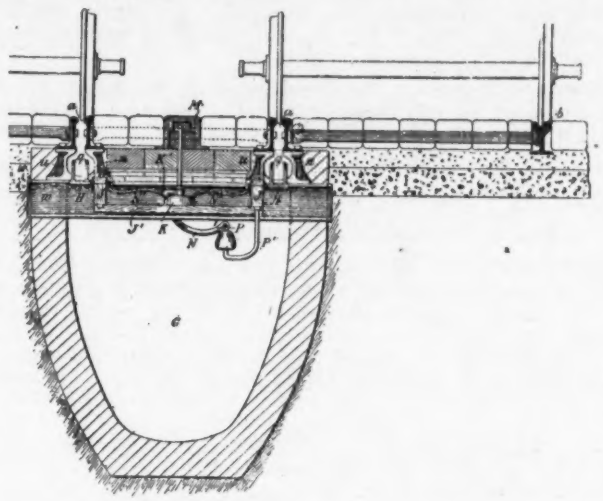
Electrically Operated Colliery at Wyoming, Pa.—The "West. Elec.," July 27, and the "Elec. Eng.," July 24, give brief descriptions of this plant, the former journal containing illustrations of the locomotive and the pump.

Utilization of Water Power in Connection with an Electric Power Plant.—"Elec. Power" for July contains an article by Mr. Herzig in which he discusses the subject in a general way and gives some data concerning existing plants.

Re-heating Molten Steel.—According to the "Elec. Rev.," July 24, the Carnegie Steel Company recently tested a new method of re heating molten metal which has become chilled before it can be poured into the moulds, which consists in passing an electric current through it; the molten metal was "set to bubbling and the light and heat were so intense that the workmen's eyes seriously suffered"; the experiment is said to have been successful and the "results promise to become indispensable in the manufacture of steel."

TRACTION.

Conduit System in Paris.—"L'Energie Elec.," July 1, gives a brief illustrated description of the system which the municipality has decided to adopt for the Porte Montmartre-Place Cadet line, of which the following is a full abstract. The system is that known as the Holroyd-Smith and is said to be the same as that which has been running for seven years in Blackpool, Eng.; the municipal authorities decided unanimously that the conduit must be sufficiently large to enable the underground parts to be inspected without tearing up the street pavement. The arrangement is shown in the adjoining illustration; *qq* are the conductors and as shown they are placed under the inside rails of a double-track system; the conduit *G* is sufficiently large to enable a man to pass through and inspect the parts; as the wires are supported on the insulators *HH*, which rest on the wooden pieces *JJ*, which in turn rest on the beams *W*; *P* is a feeder and *K* (apparently operated from *M*) is a switch for disconnecting the conductors from the feeder while making repairs; the conductors are both connected to the positive pole of the machine and the return circuit is made of a special wire to avoid electrolysis; (presumably a shunt to the rails). The traffic on this line



will be very great; in spite of the first high cost it is estimated that the cost of operation will not exceed 0.30 franc per car km (9.66 cents per car mile); the station will contain three units of 150 hp each of which one is a reserve.

Coal Consumption in Different Systems of Traction in Paris.—"L'Energie Elec.," July 1, gives the following figures for three systems which are used in Paris; the cars are double-decked and carry 54 passengers seated. The compressed-air line, St. Augustine-Vincennes, consumes an average of 11 kg of coal per car km (39 pounds per car mile); the steam line using the Serpollet steam boilers consumes 4.17 kg per car km (14.8 pounds per car mile); on the St. Denis accumulator line the consumption is 2.46 kg per km (8.7 pounds per car mile); the latter figure is almost the same as that on the trolley line in Lyons. It is concluded from this that the electric system, whether by accumulators or by trolley, requires under similar circumstances 2.5 times less coal than the Serpollet steam system and seven times less than the compressed-air system, thus showing the unquestioned superiority of electric traction considered from the point of view of economy. (It is no more than fair to the steam system to add that the above refers merely to the coal consumption and does not include other operating expenses; in a steam system for instance no central station is required).

Railways in France.—"L'Ind. Elec.," July 10, publishes a table taken from government reports which gives some figures regarding length and operating expenses of the street railways in France. The ratio of the receipts to the expenses of all the electric lines is considerably less than that of all the other methods of traction, except on one electric line which is running at a great disadvantage; these ratios for the electric lines vary from 53 to 59 per cent., while those for the other systems lie between 70 to 99 per cent., and on one on which compressed air is used it reaches 120 per cent.

Series-Parallel Controller.—According to the Lond. "Elec.," the English patent of Dr. John Hopkinson, No. 2,989, July 7, 1881, came to an end July 7 of this year; the object of this patent is the coupling of two or more motors in series or parallel for varying the speed of vehicles.

Jungfrau Railway.—According to the "Zeit. f. Elek.," July 1, prizes amounting to $10,000 are to be offered for the best proposals for this road; it is stated that the money required for its construction has been secured, being subscribed largely by native and foreign banks; it is thought that work on the first section will be begun this year; the observatory will be placed on the Moench, the neighboring mountain, while on the top of the Jungfrau a so-called flying observatory will be constructed.

Electric Carriage.—"L'Energie Elec.," July 1, states that although the Jeantaud electric carriage did not win the race in France, it demonstrated beyond question that electric traction on streets and roads is practical, and this after only a few months of trial; both the motor (Rechniewski) and the accumulator (Fulmen) stood the race of 600-km very well.

Electric Carriage.—The Morris and Salom carriage which has been running in Philadelphia for nearly a year, is illustrated and described in the "Elec. Eng.," July 24. Its total weight without passengers is 4,250 pounds including the battery which weighs 1,600 pounds; the maximum speed is 15 miles an hour and the maximum mileage for one charge 50 to 100, depending on the speed and grades; there are 60 cells of 100 ampere-hours, or 13 hp-hours at the maximum discharge rate; it contains a 3-hp motor weighing 300 pounds and capable of developing for a short time 9 hp; it is geared to a countershaft having the usual balance

ing gear; it has a seating capacity of six, but there is said to be ample power for carrying 12 to 15 people.

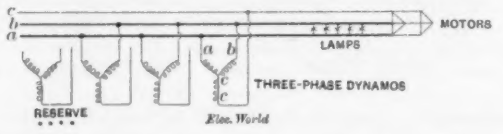
Self-propelled Vehicle Test.—Some of the illustrations from "La Nature," of those used in the recent race in France, together with abstracts from the remarks of Mr. Hospitalier (see Digest, July 20), are reprinted in "Elec. Eng.," July 24; it also gives the chart showing the speeds of the various contesting carriages.

Accumulator Traction —The recent paper by Mr. Sarcia which was fully abstracted in the Digest, June 1, is reprinted in abstract in "El'ty.," July 24 (see also Digest, June 8 and 29).

Jersey City Electric Railway Company.—An illustrated description of this plant is begun in the "Elec. Ry. Gaz." July 25.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Combined Single and Three-Phase System at Dresden.—The "Elek. Zeit.," July 4 and 11, contains a long well-illustrated description of the plant for supplying light and power to all of the railway stations in Dresden; references to this system and its similarity to the monocyclic system were given in the Digest, July 20. The system used is shown in the adjoining illustration; the generators are all three-phase 200-kw



dynamos generating 150 volts with a frequency of 100; the motors are connected to all three wires, but the lamps are connected to only two of the mains, as shown; at the stations as many generators are connected to all three circuits, as are necessary to furnish the power required for the motors, while the current required for the lamps is generated by similar generators, but with only two poles connected to the circuits, as is shown in the figure in which the two middle generators supply the lighting currents and the right hand one the motor current; only the lighted circuit is regulated for voltage; the current is transformed up to 3,000 volts and transformed down again at the places of consumption; the cost of generators is slightly greater in such a combined system than for a simple system, but the regulation is much better; the rotating field for the motors is made somewhat irregular by having the lamps on only one of the three circuits but as the motors and the lamps are used simultaneously only during about one hour a day, this feature is of no great importance; three electrostatic voltmeters are connected with one pole to earth and the others to the high-tension circuits so that if there is ground the deflection of the corresponding voltmeter will fall and that of the other two will increase; the inventor of this system, Mr. Ulbricht, who is the author of this present article, found by experiment that if two machines are thus connected in parallel to the same lines one of them may be made to generate all the current required by the motors while the other generates that required for the lamps; this is accomplished by limiting the steam required for driving the former to that corresponding to the energy used in the motors; when the power generator is generating that required for the motors only, the voltmeters on all of the three circuits will read alike even if the circuit containing the lamps is transmitting 10 times as much energy as the other two; the introduction of transformers does not alter these conditions. Illustrations are given of the curves of the various currents under different conditions; although the demand of power for motors is great yet that required for light is considerably greater; all the generators and transformers are connected by the star system, as shown in the illustration; the meters therefore give the power used for motor by taking all three readings and that used for lighting by a suitable addition and subtraction of the three readings; the whole circuit is insulated from the earth; the plant has been running very satisfactorily and is now generating 34,000 kw-hours per month for lighting and 11,000 for motors. The arc lights used have a voltage of only 28, and are said to give a very satisfactory yellowish, white light.

ELECTRO-PHYSICS AND MAGNETISM.

Thermoelectric Properties of Pure Metals.—The Lond. "Elec. Rev.," July 12, summarizes some of the results given in a long paper by Mr. Noll in the "Ann. d. Physik. u. Chemie," 80, p. 874. Owing to the disagreement between the results of different workers he considers it desirable to redetermine the E. M. Fs. of various combinations, using the metals in the highest possible condition of purity. The second metal was always mercury; the ranges of temperature were 100 degrees *C* to *O*; the results are expressed in micro-volts in the following table, + values indicating a current from the metal to the heat junction and — values those in the opposite direction. In many cases the effect of small quantities of impurities was strongly marked and even great, which throws some light on the discrepancies between the results of previous observers; for instance, platinum gave values as high as +593.88, and copper as low as 684.29 when these metals were not absolutely pure; he stated that physical aggregation also has a marked effect. The second series of experiments was made between 0 degrees and 217 degrees which agreed well with the others; he gives a formula which contains two constants and agrees with the results.

Metals, etc.	Microvolts
Bismuth	— —6,705.4
Nickel	— —1 664.2
Cobalt	— —1,522.2
Nickel, silver	— —1,085.2
Platinum	+ 4.59
Aluminum	+ 362.4
Magnesium	+ 391.84
Tin	+ 396.03
Lead	+ 402.5
Brass	+ 443.31
Carbon rod	+ 662.88
Silver	+ 710.25
Gold	+ 713.35
Copper	+ 725.58
Zinc	+ 692.71
Cadmium	+ 875.09
Carbon filament	+ 1,452.0
Iron	+ 1,601.4
Piano wire	+ 1 732.3
Antimony	+ 3,379.6

Thermoelectric Powers of Metals and Alloys.—The "Phil. Mag." for July contains an article by Profs. Dewar and Fleming which is abstracted at some length, including the illustrations, in the Lond. "Elec.," July 12; they determined the thermoelectric powers between the temperatures of the boiling point of water and the boiling point of liquid air, the results being carried down to about —200 degrees *C*; the chief interest attached to these investigations was to determine whether the thermoelectric lines of various metals remain straight between these wide limits of low temperature and whether any of the metals exhibit changes at low temperatures which causes the lines to be bent or broken; the results are given in the form of a chart of thermo-electric motive forces of metals and alloys in conjunction with pure lead, as a thermo couple, the temperatures being given in platinum degrees. Considerable space is devoted to the description of the platinum thermometer used and to a description of the tests. The resulting lines are in all cases curved; a full discussion and interpretation of the curves will be given in a further communication; at present they merely note that none of the thermoelectric curves are true parabolas over their whole extent; many have a double curvature and in some cases point to the existence of more than one neutral point with lead; they expect to convert the chart into one of thermoelectric powers; in the present diagram the lines of iron and pianoforte steel as well as some others have changes of curvature at certain points; the antimony line indicates that the thermoelectric line of antimony cuts that of lead twice; the bismuth lines are very peculiar; both those for pure and commercial bismuth have a sudden break at about—80 degrees; bismuth behaves in thermoelectric power at low temperatures, much like iron in regard to magnetic property at high temperatures.

Thermoelectromotive Forces.—The following results from a recent paper by Messrs. Van Aubel and Paillot are abstracted in "L'Ind. Elec.," July 10. In studying the E. M. Fs. of metals and alloys used in resistance boxes they find that they may be represented by the following parabolic formula:

$$E = a\,(T - t) + b\,(T - t)^2 \text{ microvolts}$$

T and t being the temperatures of the two junctions in centigrade degrees and a and b being the constants which are as follows, respectively: iron-constantan 46.74 and 0.079, aluminum-constantan 36.69 and 0.053, constantan-manganese 39.56 and 0.036.

Physical Properties of Manganese Steel.—A recent paper by Mr. Le Chatelier, from the "Comptes Rendus," 119, p. 272, is abstracted briefly in the Lond. "Elec. Rev.," July 12. He first gives the properties of the best-known form of manganese steel, namely, that containing 13 per cent. of manganese; this alloy is non-magnetic and has the highest electrical resistance of all the alloys of iron, namely, about 1 ohm for a wire, 1 m long and 1 mm in diameter. Mr. Hadfield recently discovered an allotropic modification of this alloy possessing strikingly different properties, the most notable being that it is magnetic; this alloy is the subject of the present investigation. The magnetic form is obtained by annealing the non-magnetic alloy; this transformation is effected at 500 to 650 degrees C. and is complete in one or two hours, the most favorable temperature being 550 degrees C.; to reverse the change it is heated to a temperature not lower than 800 degrees C. and cooled rapidly. A table gives the variations of the electrical resistance at different temperatures for both these alloys, for a wire 1 m in length and 1.4 mm in diameter; at 15 degrees C. the non-magnetic alloy has a resistance of 1.06 ohms and the magnetic 0.88 ohms, at 500 degrees these increase to 1.65 and 1.50 respectively while at 1,020 degrees they are both at 1.97; the two curves of electrical resistance meet at about 740 degrees and become identical at higher temperatures, this being the temperature at which pure iron passes from the magnetic to the non-magnetic state, which leads to the hypothesis that manganese steel is a mechanical mixture of iron and a definite compound of iron and manganese would not be magnetic.

Production of Long Sparks on the Surface of Water.—If the two poles of a source of high tension touch the surface of a liquid one obtains at the moment of discharge a brilliant and burning spark over the surface of the water; this superficial spark which can also be produced on other poor conductors generally has a great length 20 times over the maximum spark length in the air between two spheres. In "L'Eclairage Elec.,"

July 6, Prof. Righi suggests a theory for this superficial discharge, and describes an experiment to prove the theory; the apparatus, which is illustrated, consists of a horizontal glass tube containing water, which is placed in a discharge circuit in which there is a spark gap, a number of wires pass into the tube laterally making contact with the water and ending in knobs; on passing a discharge through the water column, sparks will pass between these knobs. He explains the formation of the superficial discharges by saying that when the charge commences it passes through the water and establishes between the points of the surface of the liquid a difference of potential sufficient for the first spark; this suddenly diminishes the total resistance of the circuit which lengthens the first spark causing a second and so on; he has obtained sparks in this way two meters in length and believes they may be made to attain 4 to 5 metres; he believes this explains the very great length of lightning discharges; if his theory is correct these superficial sparks are not all produced simultaneously throughout their whole length but first begin at the extremities and then meet in the middle.

Magnetic Properties at Low Temperatures.—The Lond. "Elec.," July 12, reprints with illustrations a Royal Institution discourse by Prof. Dewar on "Scientific Uses of Liquid Air," a portion of which refers to experiments made on the magnetic moment of small magnets cooled to—180 degrees; small magnets from one half to one inch long were made of watch spring or steel wire and placed in the field of a magnetometer; the cooling was affected by applying a cotton wool sponge of liquid air; the results are given in a table; from this he concludes that every magnet has individual characteristics that may result either in no change on cooling or an addition or subtraction of from 12 to 24 per cent. in the magnetic strength; they all show that a repetition of the cycle of heating and cooling brings the magnet to a steady state in which cooling always causes an increase in the magnetic strength of 30 to 40 per cent. and the reheating brings about no loss in the original magnetic moment; this marked alteration of magnetic strength could be used as a thermometer in low temperature research.

Magnetic Asbestos.—Mr. Bleekrode, in a recent number of the "Wied. Ann.," states that the magnetic properties of Bell's asbestos were often more marked than was the case with the sample tested by Mr. Swinton (see Digest, Dec. 1); an ordinary steel magnet was sufficient to demonstrate the existence of magnetism; he states that the substance may contain iron, but he boiled some gray asbestos for several hours in concentrated sulphuric acid and it still retained its magnetic properties.

Electromagnetic Magnetism.—The article by Mr. McMahon (see Digest, July 20), is continued in the "Lond. Elec.," July 12; he gives the results of several experiments, which may be of some interest to those working in this field; no conclusions are drawn and the results do not admit of being abstracted.

Inductance of the Dielectric.—Mr. Stone in an article in the "Elec. Rev.," July 24, gives a comparatively simple explanation of the meaning of the term "inductance of the dielectric," as used by Mr. Heaviside; he believes that a conception of this expression would lead to a clearer understanding of the reaction of the so-called "skin effect" on the inductance of a circuit; he believes that great simplification may be gained by the use of the properties of the inductance of the dielectric.

ELECTRO-CHEMISTRY AND BATTERIES.

Chlorine and Soda.—In "L'Elec.," June 22, Mr. Andreoli reviews the figures recently given by Mr. Haeussermann (see Digest, May 11), giving the cost of production of caustic soda by the electrolytic process and criticises them very unfavorably. He claims among other things that 3.55 volts per cell is not sufficient and that at least five volts are required and that therefore instead of 832 hp during the 24 hours for producing five tons of caustic soda, it will require about 1,200 to 1,300. He calls attention to a number of important points which were left out of consideration in that article. A brief summary is given of what is being done at existing plants; the process recently patented by Gebauer in Germany, he claims, is the same as one described in 1891, giving the reference; the British General Electric Company, working the process of Hargreaves & Bird, have made some changes which are expected to lead to interesting results; one of the characteristic features of this process is that there is no liquid in the negative compartment; according to Mr. Jackson, of Birmingham, where the Castner process is used, the caustic soda is practically pure, the chlorine does not contain more than 3 to 5 per cent. of impurities, three tanks yield per 24 hours 1,320 pounds of soda and a corresponding quantity of chlorine, which is used for making chlorate of potash; with 14 tanks in continual operation during 24 hours in a day and by the expenditure of 2,440 hp, 23.05 tons of caustic soda were obtained representing the decomposition of 33 67 tons of pure salt and 20.4 tons of chlorine; the mean hp used is 49.9 or 7.50 kg per hp; the loss of mercury is said to be insignificantly small.

Aluminum.—According to the "Zeit. fuer Elek.," June 15, the process of Roger in Paris, for obtaining a very pure metal by an electrolytic method requiring only a small amount of energy, is as follows: aluminum hydroxide or the mineral bauxite dissolved in sodium hydrate forming a basic solution of aluminum oxide, is introduced in a non-conducting vessel containing mercury in the bottom, which forms the anode, the cathode consisting of a combination of bauxite and carbon; by the passage of the current the aluminum of the solution will be alloyed with the mercury while the metallic sodium set free will combine with the bauxite of the cathode, forming a basic aluminum oxide which keeps the composition of the electrolyte constant the amalgam is freed of the mercury by distillation.

Reduction of Silica by Carbon.—In an Academy note by Mr. Moissan, abstracted briefly in "L'Ind. Elec.," July 10, he showed that in his furnace silica is reducible by carbon at high temperatures producing silicum by cooling the vapor of the silicum immediately after its production; this process can be applied for the preparation of silicum.

Molybdenum.—The preparation and the properties of this material in the electric furnace, are described in an Academy note of Mr. Moissan's reprinted apparently in full in "L'Eclairage Elec.," June 29; the material can be obtained pure and in a melted state in the electric furnace.

Electrolytic Deposition and Reduction of Copper.—Two papers from the German describing some practical experiences on a commercial scale, are summarized in the Lond. "Elec. Rev.," July 12.

Purifying Sugar.—Mr. Svilokossitch, in "L'Elec." July 6, gives some of the results obtained by Mr. Dammeyer in the application of his process to the purification of beet juice as used at the sugar refinery at Ottleben, Germany, where this process has been in use for a year. The figures are given in the form of tables together with those obtained the previous year by the old process; they show that the electric treatment increases the product obtained and diminishes the cost of the chalk, while the efficiency is appreciably increased; he also states that the electric process is being introduced more and more in Germany and Russia.

Iron Plating.—Under the head of process for hardening copper the "Elek. Anz.," July 11, gives the following receipt: 50 parts of sal-ammoniac and 100 parts of the double salt of iron sulphate and ammonia, are dissolved in 500 parts of distilled water, a few drops of sulphuric acid being added to make the bath acid; the copper is connected with the negative pole of a source and for the anode a sheet of iron is used; the density of the bath is 60 to 80 degrees; two Bunsen cells will suffice; the coating of iron is formed quickly and is as hard as steel.

Accumulator.—The "Zeit. f. Elek.," July 1, publishes a complete though brief report of the Reichsanstalt on some tests of the "Austria" accumulator made in Vienna. It appears that only a single cell was tested and it contained 6 negative and 5 positive plates 20 cm high by 16 cm in breadth and 6 mm thickness; the plates were sealed in a transparent celluloid retaining cell; the complete cell with plates and acid weighs 32 pounds; several charges and discharges were made, the results of which are given in a table, the average of which is a discharge of 267.6 ampere-hours which is equal to about 8.4 ampere-hours per pound; the weight of the plates is given by the maker as 22.22 pounds; the discharge was continued down to 1.8 volts and the charge was stopped at about 2.5 to 2.58 volts, the charging current was in most of the discharges 13 amperes and therefore the time of one discharge was over 20 hours (which is an exceedingly slow rate of discharge, far too slow for most purposes for which a light cell is required). The cell was next overcharged for five hours at 50 amperes; a current of 500 amperes was then taken four times from it and each time for one minute and after that a current of 100 amperes for 1 5 hours which was continued until the voltage read 0.3 volt the current having by that time fallen to 30 amperes; the total discharge was 240 ampere-hours; it was then charged at a slow rate at 600 ampere-hours and then found to give its normal capacity again; with the exception of a slight blister on the negative plate the plates did not appear to be damaged.

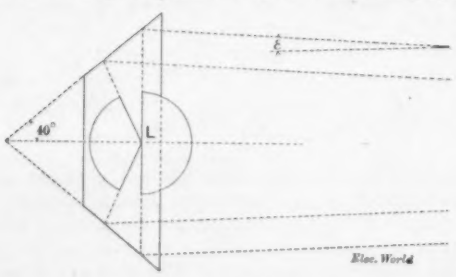
Indirect Electrolysis.—"Genie Civil," July 3, contains an interesting article by Mr. Andreoli, a translation of which appears in "El'ty," July 24. A vessel is divided by two porous diaphragms into three compartments, one of the end ones containing an anode and the other end one a cathode; if the middle compartment is filled with any solution whatever either similar or different from those in the other two, the decomposition of the electrolytes in the end compartments takes place the same whether there is a central compartment or not, and the electrolyte in the central compartment remains unchanged; but if one or more metallic plates are placed in the middle compartment reactions are produced which he states can be attributed only to an indirect or secondary electrolysis. He does not believe that this phenomena has ever been mentioned before and he gives it the name of "indirect or secondary electrolysis." If the end compartments contain salt water, one with an electrode of retort carbon and the other one of iron, and if the middle compartment is filled with cyanide of gold, then if one or more metallic plates are inserted in the middle compartment parallel to the diaphragms, gold will be deposited on these plates although they are connected neither to the poles of the dynamos nor to the other electrodes; the solution in the middle compartment will not be contaminated with either chlorine or sodium from either of the other two and it will sooner or later be completely exhausted of its gold; the layer of liquid toward the negative compartment becomes positive, which is proved by the fact that this side of a lead plate will be peroxidized while the other side will be covered with gold, from which it follows that reactions of a

special character may be produced. If chloride of gold be placed in all three compartments the quantity of gold in the end ones remains the same after passing a current through the system for several days; there was no trace of gold on the negative plate although 100 litres of the gold solution were exhausted in the central compartment; this method enables him to transform bisulphide of sodium into hydrosulphite, the nature of the liquids in the lateral compartments being of no consequence, the choice being based on their being good conductors and not requiring special electrodes; he states here that, as in the electrolysis of gold solution, there was no effect when there was only one metallic plate in the middle compartment, but when two plates were used the reaction took place with the evolution of gas, the liquid acquiring bleaching powder; he prefers to use perforated plates. He lays particular stress on the fact that there is but one liquid in order that this phenomena should not be confounded with an old experiment in electrolysis; in the present phenomenon, contrary to what is usually believed, there is a transference of ions from one of the end compartments to the other across an inert electrolyte which they do not affect. There are several precautions which it is necessary to take, in order to obtain good results; there are objections as well as advantages of this method; secondary electrolysis is entirely different from the ordinary when the question of electro-deposition is considered, as the bath around the anode is not a bath of the metal. (Nothing is said regarding the effect on the voltage, of introducing these intermediate plates.)

New Accumulator.—"Elec. Age," July 27, gives very briefly some features of a new secondary battery which is at present exhibited in Brooklyn. It is a Plante cell, the lead plates are quite thick and are made porous by mixing a granulated substance with the metal before moulding, which looks like grains of flint; it is claimed that for a given capacity the weight can be made less than one half that of any other battery and that it can be placed on the market at one half the cost of any accumulator now in general use. The cross-section of the plate is shown in an advertisement in the same issue.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Measuring the Mean Spherical Intensity of Light.—Prof. Blondel's long article (see Digest, June 29), is concluded in "L'Eclairage Elec.," June 22 and 29; much that is contained in it has already been referred to and described in the abstract in the Digest, the present article being much more complete than the previous one. He describes how the lumen-metre is calibrated; he believes that all the errors of the apparatus ought not to exceed 2.5 to 3 per cent. which is very satisfactory for such measurements; as an illustration of measurements made with the instrument he gives results of the determination of the total luminous flux of two arc lamps one having carbons 21 and 13 mm in diameter and the other 14 and 8 mm; for 20 amperes and 44 volts the former gave 7,900 lumens and the latter 21,300, and for 35 amperes and 46 volts the figures were 28,100 and 61,300 showing that the flux is nearly trebled by using the smaller carbons. He discusses a modified apparatus in which total reflection is used in place of reflection from a silvered mirror; besides being expensive the glass ring would be very heavy and would absorb considerable light; he discusses another method in which a spherical diffuser is used, the theory of which is discussed at some length. The third method is that of diffused reflection; it was mentioned in the abstract in the Digest, June 29; in the adjoining figure the light



L is surrounded by an opaque globe which has an opening in the form of a zone, as shown; the light passing through this opening in the vertical zone falls on the conical diffusing reflector the illumination of which is then measured by the photometer. In order that the illumination should be proportioned to the luminous flux which passes through this zone, the angles of incidence and reflection must be approximately constant for all the rays, for if not, the reflecting power will vary; if the photometer is placed 7 to 8 metres from the diffuser the angles of the reflected rays will be practically constant but that of the incident rays will not; extensive researches were carried out by him, the results of which are given, to determine the importance of this error; he finds that paper will not answer for the diffuser while marble and porcelain will; the conditions are well filled by an enameled sheet metal diffuser the gloss of which has been taken off with hydrofluoric acid; he finds that an angle of 50 degrees for the cone is best; it is better to reduce the angle of the zone to 10 degrees and not to use a light having a diameter greater than one tenth that of the screen; with a lumen-meter of 60 cm diameter and a photometer placed 9 metres from the centre, the distance of the points of the screen to the photometer vary only 1 per cent.; considering all the sources of error he believes the total error will not exceed 5 per cent.

Standard of Light.—A Physical Society paper by Mr. Violle is abstracted briefly in "L'Elec.," July 13, and "L'Ind. Elec.," July 10, the latter journal promising the publication of a more detailed description; all that is contained in the present note is as follows: he used acetylene gas and endeavored to obtain a practical standard lamp for the usual photometric measurements; by burning the gas under a rather strong pressure in a suitable burner in the form of a large thin flame he obtained a perfectly fixed bright flame which was remarkably white and had a uniform brightness over a sufficiently great surface; in front of this frame is placed a screen like the Methven and he thereby obtained a source of light which in steadiness, brightness and whiteness compares with the absolute standards and forms a practical standard which is reliable and convenient.

Measuring High Temperatures.—"L'Eclairage Elec.," June 22, abstracts a paper of Mr. McCrae, from the "Wied. Ann.," vol. 55, No. 5, in which he describes the method of measuring the points of fusion of a number of minerals and salts, with the aid of a thermoelectric couple of platinum and a 10 per cent. alloy of platinum and rhodium; the wires were 10 cm long and 0.2 mm in diameter the joint being placed directly in the fused salts; the apparatus was calibrated by placing it in fused substances of known temperatures; the results for a number of salts are given; he also measured the temperature of the alcohol flame and found it to be 1,488 degrees C, that of the Bunsen flame in the blue cone was 1,542 degrees and in the hottest part of the flame 1,725 degrees.

Iodine Voltameter.—Prof. Herroun's Physical Society paper on the uses of an iodine voltameter for the measurement of small currents, which was abstracted quite fully in the Digest, June 15, is published in full in the "Phil. Mag.," for July; it is quite brief.

Volt and Ammeters.—A description of the Arnoux-Chauvin instruments is published with illustrations in the Lond. "Elec."; a description was given in the Digest, May 11.

Electrical Wiring Institution.—The Lond. "Elec., Rev.," July 5, published a number of illustrations of the interior arrangements of the Electrical Standardizing, Testing and Training Institution of London, which has been in existence for several years and which, besides giving a course of instruction, undertakes the calibration of instruments and other similar work.

Magnetic Symbols and Terms.—Mr. Kingdon, in a communication to the Lond. "Elec.," July 5, states that instead of the unit of magnetic intensity (ß, what is really wanted is a unit of magnetic flux analogous to the ampere; the term "magnetic line of force" used by some as the unit of flux does not convey an accurate idea of the nature of the quantity which is measured; he has used the term "mag" to denote the C. G. S. unit of the magnetic flux and has found it extremely convenient; induction can then be readily expressed in mags per square inch or centimetre; the terms erg and dyne would form a precedent for the adoption of the term mag.

Variable Potential of a Rheostat.—In an article by Mr. Stine in "Elec. Power" for July he describes an instrument for obtaining variable potentials as used for instance in the calibration of voltmeters. It consists of the old and well-known rheostat of Wheatstone modified and improved; the chief modification consists in using two insulated cylinders instead of one, the guide for the wire being used to take off the intermediate potentials. The apparatus consists of two horizontal cylinders made of insulating material and having a light thread with a pitch of 36 to the inch cut on them; these cylinders are revolved by a crank and gears, and by this means a resistance wire which is wound on one of them, may be unwound to any desired extent by winding it up on the other. The length of the resistance wire is about 235 feet; a No. 30 German silver wire of 340 ohms was used with good results with 110 volts; in another an eight mil wire of nickle alloy of 1,095 ohms is used for 150 volts and in another a 5 mil wire of the same alloy, of 2,680 ohms was used for 300 volts.

Measuring Instruments.—In "Elec. Power" for July an article by Mr. Wiener is begun; he describes with the aid of diagrammatic illustrations the principle of a number of practical instruments, most of which are well known; the present portion is devoted to ammeters.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Accumulators in Telegraphy.—In "L'Elec.," July 6, Mr. Montpelier describes in detail with the aid of a number of good illustrations, the installation of accumulators at the central telegraph station in Paris. Being almost entirely descriptive, the article does not admit of being abstracted; the currents have different circuits and are taken from as many of the cells of the series groups as are necessary to give the required voltage, the resulting different discharges of the various cells causing no inconvenience as it is provided for in the system in a satisfactory manner; great precautions are taken to avoid trouble due to accidental earths; each group contains individual resistances consisting of a fine wire fuse which melts when the current exceeds one ampere; in addition there are fuses in the common earth return connection and

in the conductor of each group; the switchboard for charging and discharging batteries with all the necessary apparatus, is illustrated.

Reporting Races from a Balloon.—"Elec. Age," July 27, states that the races between the *Defender* and the *Vigilant* were reported for the "New York World" from a balloon sent out near Sandy Hook, communication being established by telegraph through a small cable; this method obviates many difficulties heretofore experienced and removes all doubts concerning the identity of the boats when they are too far from the land to be distinctly watched.

Telephone Relay.—The "Elec. Eng.," July 24, gives a brief illustrated description of the Arnold relay for which a patent was recently taken out, and assigned to the Bell Company. "The essence of the invention consists in associating the relay or repeating apparatus proper, including its local repeating-circuit, with a short but conductively complete auxiliary section of the main line, and in combining the section and its associated repeater mechanism and arrangement with the two main telephone circuits which are desired to repeat into each other, in such a way that it is inductively connected with both by means of repeating induction coils, and thus constitutes a link connection between the two main circuits, uniting them into a single compound circuit for through communication. At the same time the balance is much facilitated by reason of the shortness of the complete middle-line section thus interposed at the central, intermediate or repeating station between the ends of the two circuits concerned."

MISCELLANEOUS.

Heat Radiated from the Skin Under the Influence of Continuous Currents.—In an Academy paper by Mr. Lecercle abstracted in "L'Eclairage Elec.," June 29, he described experiments made to measure the heat radiated from the skin, as distinguished from the temperature of the skin itself; he experimented on rabbits and found that the radiated heat in general diminishes slightly for an intensity of 10 milliamperes and increases for intensities exceeding 20 milliamperes.

Electrical Engineering Course at the University of Wisconsin.—"Elec. Power" for July contains a short article by Mr. Macrae giving a brief description of the course.

An Electromagnetic Railway System.

Patents were issued last Spring to Mr. John H. Guest, of Boston, for a closed conduit railway system which forms within itself a natural block system.

The system belongs to that class in which a sectional surface contact-strip or rail is used to convey current to a collector or brush on a car, each section of the contact-rail being put in connection with the buried mains when the car is over it and rendered "dead" after the car passes beyond it, the connection being effected and destroyed by an underground switching device which is controlled from the car.

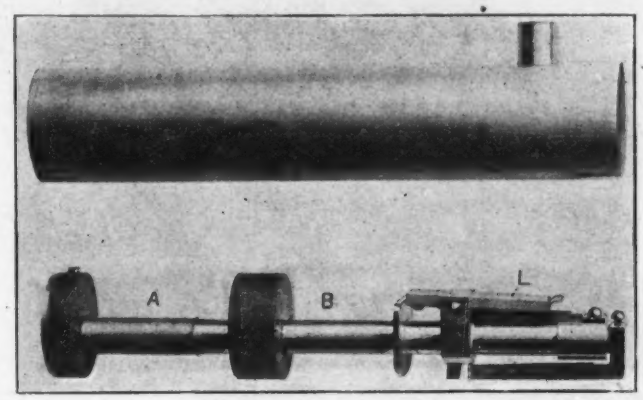
The keystone of the Guest system is the switching device used for the purpose stated, which is shown by the accompanying illustration. This switching device consists of two solenoid coils operating oppositely upon a common plunger, which operates a switch to connect or disconnect a section rail with or from the feeders, and a soft iron lever which controls the connection between the supply mains and the solenoids in a manner explained further on. In the cut the solenoid windings are omitted; the space at *A* contains the "killing" coil and the space *B* the energizing coil. When the plunger is at the extreme right of its travel, connection is completed between the feeders and that section of contact-rail nearest which the switch is located. The soft-iron lever is shown at *L*. The mechanism is sealed in a metal tube, and to strengthen or insure the influence of the magnet on the car upon the soft iron lever in the tube, a soft iron pin is encased in a projection of non-magnetic material, its upper end being flush with the roadway when the switch-tube is buried, and the lower end terminating just above the iron lever. The complete switch-tube is represented by the upper figure in the engraving.

One of these switch-tubes is placed at each break in the surface contact rail, and a magnet is located about the centre of the car, with its lower end close to the ground. The car is provided with a current collector at each end of the truck, and mounted upon it so as to obviate any trouble by reason of the oscillations of the car body.

The operation is as follows: When a car reaches a point where the break in the surface contact rail is under its centre, the magnet on the car attracts the soft-iron armature within the buried switch-tube. The armature makes connection between the main line and the solenoid coil, *B*, which effects a connection between the supply main and the contact-rail just ahead of the car. The solenoid plunger while making this connection energizes coil *B*, of the second switch back over which the car has passed, causing that switch to break connection between its section of rail and the supply main. This break is not attended by a flash because the car has previously made connection through its front collector with the contact rail ahead and the rail thus disconnected is dead.

This description applies to a system using a sectional contact rail for one side of the circuit and the regular rails for a return. Mr Guest proposes, however, to use two lines of sectional contact-rails, with switch-tubes for both, and dispense with the use of the track as a return. In this case the gaps in the contact-rails are staggered so that the gap between two positive contact-rails will be abreast of the centre of a negative contact-rail. Two magnets are used on the car, one for each set (positive and negative) of underground switches, and four current collectors, two on each side. The two lines of contact-rails are laid equidistant from the centre of the road-bed and any desired distance apart, up to three and a half feet.

It will be seen that the block system feature above referred to is



UNDERGROUND SWITCH.

obtained by reason of the "killing" by the underground switch of the contact-rail two sections to the rear of the car, which effectually prevents a car following to approach nearer than about one and a half sections.

Mr. Guest has also obtained patents covering a system in which a trolley line is used overhead and a sectional contact-rail with underground switches as above described, completes the return circuit, the advantage being that the circuit is not grounded and, therefore, the breaking and falling of the trolley wire is not attended with the same degree of danger as in an ordinary trolley system, the contact-rails being dead except at points under cars.

An Efficient Turbine.

We illustrate herewith the Little Giant turbine wheel built by William Dolan & Co., Logansport, Ind., who were pioneers in the manufacture of this class of waterwheels, the original Little Giant being patented in 1871.

It will be noticed upon inspection of Fig. 1 that the lower portion of the buckets are curved so as to realize the full effect of the downward as well as the outward movement of the water as it leaves the wheel. This feature is now used to a certain extent by other manufacturers, but Messrs. Dolan & Co. claim that the design originated with the Little Giant, and is essential to the economical operation of turbine waterwheels. One of the strong points of the Little Giant turbine is its gate, shown in Fig. 2, which consists of a complete cylinder adapted to be raised above the bucket entrances, to admit water, or lowered until it sur-

FIG. 1.

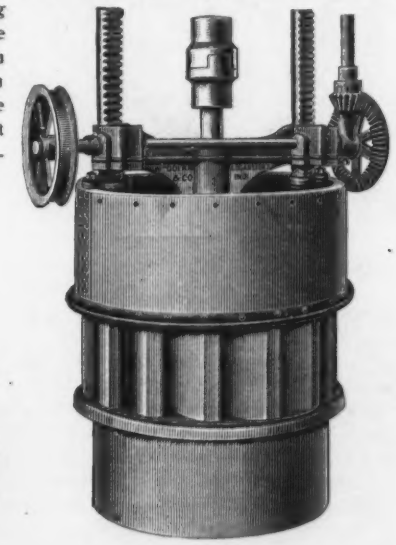


FIG. 2.

rounds them and excludes the water. A valuable feature of this gate is the absence of any tendency to close or open by reason of the water pressure; in short, it constitutes a perfectly balanced gate so far as water-pressure is concerned, the effect of gravity being easily balanced if desired. This form of gate mechanism also has the advantage of extreme simplicity and non-liability to disarrangement.

Special Dynamos and Motors.

Keeping abreast with the march of progress and the resultant demand for special machinery, the Interior Conduit & Insulation Company, of 527 West 34th Street, New York, has brought out several special types of dynamos and motors, two of which we illustrate below.

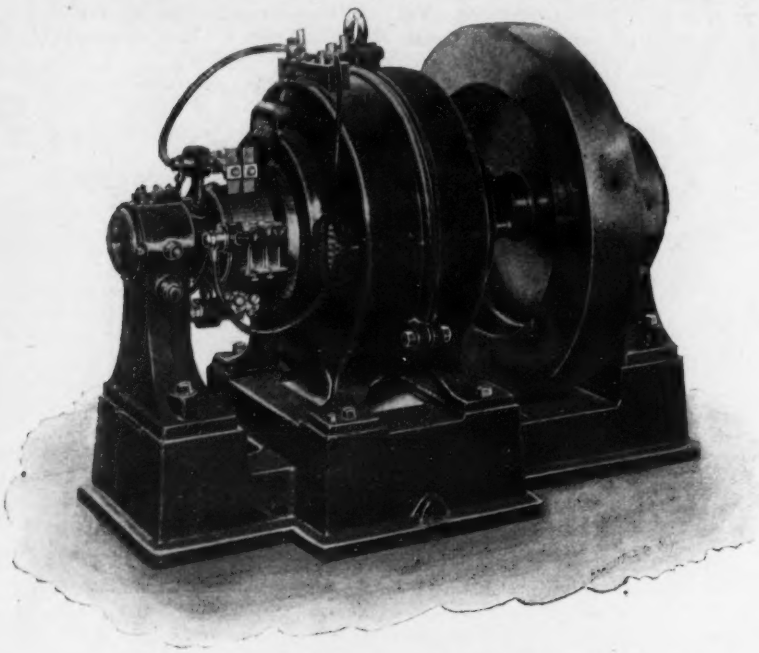


FIG. 1.—DYNAMO ADAPTED FOR USE WITH GAS ENGINE.

Fig. 1 shows a Lundell dynamo as constructed for service in isolated lighting when the motive power is furnished by a gas engine. Great improvements have been made in the last few years in gas engines, but up to this date, it is said, no gas engine of more than 5 hp has been brought out which can be depended upon to operate at uniform speed under sudden variations in load. In order to compensate for this instability the type of dynamo here shown is provided with a heavy fly wheel which tends, as is well understood, to preserve a uniform rate of rotation by reason of the storage of energy in the wheel. These machines are provided also with special pedestals, journals and shaft, which are made much heavier than in the regular type of dynamo, and they are mounted on a substantial sub-base which adds greatly to their stability and smoothness of operation. The journals are self-oiling and self aligning These dynamos are made in various sizes ranging from 5 to 30 kilowatts and to run at from 1,100 down to 550 revolutions per minute.

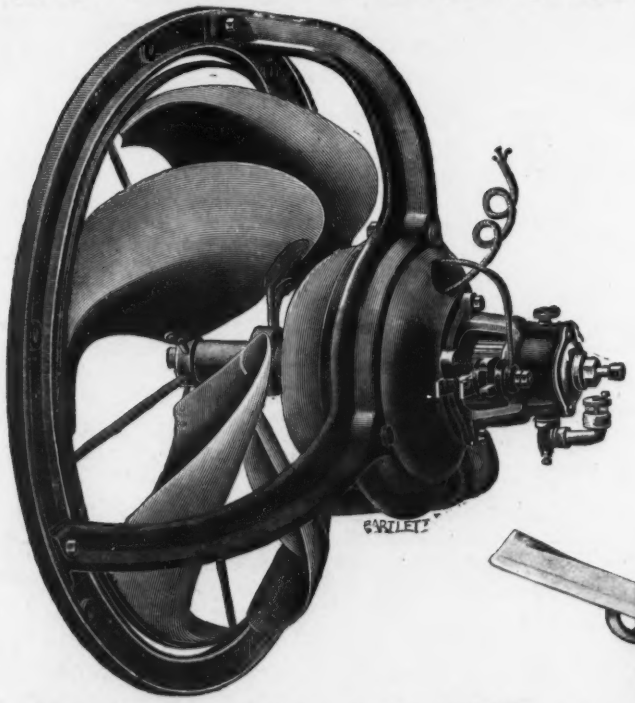


FIG. 2.—COMBINED MOTOR AND EXHAUST FAN.

Fig. 2 shows an exhaust fan combination which is particularly compact, the design of the Lundell motor rendering it peculiarly well-adapted to this class of work. The motor, being iron-clad, is almost wholly inclosed and easily permits of connection by radial arms, spider, or bolts to any of the many forms of exhaust fans now to be found in the market. It has been the practice of manufacturers of exhaust fans to supply a bearing in front as well as in the back of the fan, but in this particular combination a shaft, which may be horizontal or vertical, is carried in two bearings in the motor frame itself, not supported in any sense from the fan ring. This practice insures perfect alignment and noiseless running. All the Lundell exhaust-fan outfits are made with horizontal shafts, unless otherwise desired, and are invariably made so that the direction of the flow of air is from the motor toward the fan. If it is desired to operate the fan with a vertical shaft or to drive the air through the fan and over the motor, the outfit can, of course, be made to fulfill these conditions. With all standard horizontal-shaft fans, an adjustable thrust bearing, as shown in cut, is provided. When the flow of air is desired contrary to the standard direction, a button and thrust bearing is placed at the rear of the motor.

In all the horizontal-shaft fans lubrication is effected by oil. In the vertical-shaft fans, lubrication is effected in an oil receptacle enclosing a step at the bottom of the shaft, and a graphite or other self-lubricating bearing (never a grease cup or oil bearing) at the upper end of the shaft.

Interurban Railway Motor.

The adaptation of electricity to elevated and steam railway traction and the increase in suburban traffic has necessitated the use of motors of a heavier and more powerful type than those ordinarily used in street railway service. To meet the demand created by this need, the General Electric Company has recently designed and put out two sizes, known respectively as the G. E. 1,200 and G. E. 2,000. These have already been long enough in service to show that they meet the requirements of the heavier service satisfactorily.

The G. E. 2,000, shown in the accompanying illustration, is designed for a draw-bar pull of 2,000 pounds when mounted on 33-inch wheels (hence its appellation). Complete with gear case, it measures 50 inches in width, and is therefore adapted to use on standard gauge axles. For its power its weight is comparatively light viz., 4,300 pounds. The armature is of the "barrel" type, a method of construction which allows of the ready repair of a damaged conductor. The iron-clad armature construction, so successful in street railway practice, is employed in the G. E. 2,000 motors.

These motors are now in successful operation on the cars of the Metropolitan West Side Road opened to the public this Summer in Chicago, and are also used upon the cars running on the Nantasket Beach division of the N. Y., N. H. & H. Ry., which was recently equipped for electric operation. The G. E. 2,000 motors also find a field in the driving of heavy mining machinery and numerous hoists and pumps scattered throughout the country.

The G. E. 1,200 motor is built upon the same general lines as the G. E. 800 with such modifications introduced as to give it a more powerful tractive effort. As in the case of the G. E. 800 and the G. E. 2,000 motors, it is classified by the tractive power exerted, the numeral representing the number of pounds draw-bar pull with the motor mounted on 33-inch wheels.

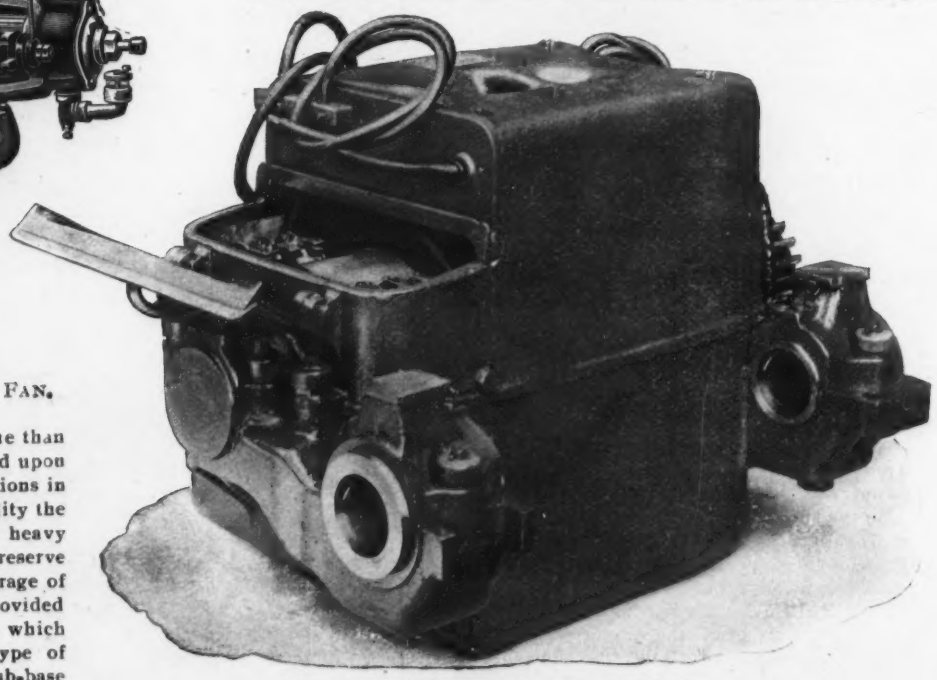


FIG. 3.—INTERURBAN RAILWAY MOTOR.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, JULY 27, 1895.

AMERICAN BELL remained quiet at 195 until the publication on Wednesday of the instrument output for the month ended July 20, upon which the stock rose to 197 and continued climbing to the close. The net output during the month is reported as 6 324 instruments, as compared with 676 for the same period last year; the total number of instruments outstanding on July 20 was 684,283, which represents a gain of 60 786 over the same date last year.

THE TRACTION CONSOLIDATION at Philadelphia was the all-absorbing theme of discussion on that floor this week and was not devoid of some attention in New York. The free liquidation of the shares of the interested companies on Thursday operated to drag Philadelphia Traction down to 83⅛, People's to 63⅛, and Electric Traction to 74½. Later along these stocks rallied slightly, but did not reach Monday's opening again. The deal, which was consummated on Tuesday, provides for the amalgamation of the People's and Electric Traction companies, the combination to lease the Philadelphia Traction property at 8 per cent. on this company's capital stock. The new combination is to be known as the Union Traction Company and is capitalized at $30,000,000. The deal has been severely criticised in the Street at Philadelphia, where the prevailing opinion appears to be that Philadelphia Traction will get the plums while the stockholders of the amalgamation look through the fence.

ELECTRICAL STOCKS.	Par.	Bid.	Asked.
Chicago Edison Company	100	120	125
Edison Electric Ill., New York	100	97	99½
" " " Brooklyn	100	..	108
" " " Boston	100	129	130
" " " Philadelphia	100	..	115
Edison Ore Milling	100	13	15
Electric Storage Co., Philadelphia	100	29	30
General Electric	100	35½	36
General Electric, pref	100	69	71
Westinghouse Consolidated, com.	50	36¼	37*
" pref	50	53	54*
BONDS.			
Edison Electric Ill., New York	100	105⅛	105⅝
Edison Electric Light of Europe	100	75	85
General Electric Co. deb. 5s	100	..	90¼
TELEGRAPH AND TELEPHONE.			
American Bell Telephone	100	199	200
American District Telegraph	100	33	40
American Telegraph & Cable	100	96	..
Central & South American Telegraph	100	117	120
Commercial Cables	100	150	..
†Erie Telephone	100	57¾	58
Gold & Stock Telegraph	100	105	..
New England Telephone	100	77½	88
New York & New Jersey Telephone	100	103	105
Postal Telegraph-Cable	100	63½	..
Western Union Telegraph	100	91⅞	92
ELECTRIC TRACTION STOCKS.			
Baltimore Traction	25	20⅞	21
Binghamton RR. com	100	100	..
Brooklyn Traction	100	16½	18
" " pref.	100	..	58
Buffalo St. Ry	100	86	90
Cleveland City Ry	100	68	70
Cleveland Electric Ry	100	59	60
Chicago City Ry	100	305	315
Columbus St. Ry	100	48⅛	..
Consolidated Traction of N. J	..	26	30
‡Electric Traction, Philadelphia	50	..	74
Hestonville	100	58½	58¾
Long Island Traction	100	10	10¼
Louisville St. Ry. com.	100	37	39
" " " pref.	100	87	887
New Orleans Traction	100	24	24½
" " " pref.	100	69	71
North Shore Traction	100	34½	37
" " pref.	100	84	88
People's Traction $30 pd	25	64¾	65
Philadelphia Traction	50	84¾	84⅞
Rochester St. Ry	..	38	..
Union Ry. (Huckleberry)	100	112	115
West End, Boston	100	72¼	72½
" " pref	100	..	20
Worcester Traction	100	18	20
" " pref	100	86	90
BONDS.			
Buffalo St. Ry. 1st con. 5s	100	106	108
*Binghamton Railroad Co. 5s	100	99	100
*Columbus St. Ry. 1st 5s	100	104	..
Rochester St. Ry. 1st. 5s	100	95	97
*Union Ry. 1st. mtge 6s	100	105	108
*Westchester Electric 1st. mtge. 5s	100	98	101

* With accrued interest.
† Ex-Div.
‡ Ex-rights.

EDISON ILLUMINATING, of New York, has declared a quarterly dividend of 1½ per cent, payable Aug. 1.

LONG ISLAND TRACTION'S reorganization appears to have proven a conspicuous success. When the time allowed for deposit of stock expired it was found that 280,600 out of the 300,000 shares of stock had been deposited. With each share turned in the sum of $5 was paid, giving the reorganization committee the immediate use of $1,400,000 fresh capital, which will be supplemented by an equal sum on Sept. 2, when the balance of the assessment is payable. Depositing stockholders will receive one share of new stock for every two shares of old stock, also new stock to the amount of $7.50 per old share, and new bonds to the amount of the cash payment of $10 per old share. The cash received will be used to wipe out the floating debt and in betterment.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
253 BROADWAY, NEW YORK, July 29, 1895.

REDUCTION IN ASSESSMENT DENIED.—The Brooklyn Board of Assessors have denied the petition of the Edison Electric Illuminating Company asking for a reduction of the assessment on its personal property, which amounts to over $1,500,000.

PORT JERVIS has made a new contract for electric street lights, rejecting the Welsbach offer for gas lights, as incomparable with electricity. The new schedule calls for 104 arcs, at the rate of $86 per year each. The total is $9,000, and a saving of $1,500 over the previous contract.

MR. GEO. THOMPSON, JR., president of the Thompson-Brown Electric Company, Boston, was a visitor in New York last week. Mr. Thompson reports business as much better than he has known it for two years, and considers the indications for the return of general prosperity as most promising.

RECEIVER FOR ELECTRICAL ENGINEERS.—Judge Stover, in the Supreme Court, last week, appointed Duncan Edwards receiver in supplementary proceedings for Neftel, O'Connor & Co., electrical engineers, of 176 Liberty Street, in a suit brought against them by John A. Roebling's Sons Company.

ANNUAL MEETING.—At the recent meeting of the Flushing Electric Light & Power Company, George Pople, David Master, S. W. McCreery, Joseph Dyks, E. Platt Stratton, John Hepburn, W. T. James, Joseph K. Murray and S. E. Morrow were elected directors. The treasurer's report showed an earning of 10 per cent. on the investment for the past year.

THE CANARSIE BRANCH of the Flynn trolley system was opened yesterday. The first car over the route was started from the power house in 37th Street and 13th Avenue at 1 30 o'clock in the morning, and went over the entire Canarsie route. Albert L. Johnson, a brother of ex-Congressman Tom L. Johnson, the builder of the road, acted as motorman, and Secretary Fred. Cochey as conductor. About 50 cars were in operation during the day. They were all crowded.

TELEGRAPH LINES IN ANNEXED TOWNS.—The Flatbush District Telegraph Company last Tuesday filed with the secretary of state a certificate amending its articles of incorporation so as to permit the company to maintain lines though that part of Brooklyn, formerly the town of New Utrecht, and also through Bay Ridge, West Brooklyn, New Utrecht, Blythebourne, Fort Hamilton, Bath Beach, Bensonhurst, Unionville, Sheepshead Bay and other points in Kings County to and through Coney Island.

A VETO FROM MAYOR SCHIEREN.—Mayor Schieren has vetoed the resolution of the Brooklyn Aldermen granting the New York & Eastern Telephone Company the privilege of erecting poles and stringing wires along the city's property between the Ridgewood reservior and Massapequa. He says he is desirous in the public interest of promoting, and shall at all times aid to promote legitimate competition in telephone service, but the resolution in question attempts without authority of law to grant an easement for private use in the property of the city.

THE FLYNN ROADS VICTORIOUS.—The Supreme Court has reversed the decision of Jus ice Walter Lloyd Smith, which set aside the franchise of the Nassau Electric and Kings County Electric Railway Companies, generally known as the Flynn roads. The privilege of operating nearly 50 miles of trolley lines within the boundaries of Brooklyn and the little town of Flatlands, which now embrace the entire territory of Kings County, was involved. In the fall of 1893, directly after the Board of Aldermen, by the vote of the so-called "cold thirteen," had granted the Flynn people a franchise, work on nearly all the lines was begun, and about $3,000,000 had already been expended when, a few months ago, the sweeping decision of Justice Smith put a sudden stop to all operations, the city authorities revoking all the permits they had granted. Work was resumed last week within two hours after the decision of the General Term had been handed down. President Flynn had a thousand men at work on the lines. Six months, however, will probably elapse before the new extensive trolley system can be completed. The company promises to carry passengers over all the lines for a single fare of five cents.

New England Notes.

Branch Office of The Electrical World,
Room 91, Hathaway Building, 620 Atlantic Ave.,
Boston, Mass., July 27, 1895.

MR. A. W. TOPPAN, 65 Sudbury Street, Boston, eastern agent for "Commercial" dynamos and motors and other electrical specialties, reports business as exceedingly good.

THE TROLLEY LINE FROM HARTFORD TO NEW BRITAIN will be built by the Newington Tramway Company, under a charter granted in 1893, which would have expired on June 29 last. On June 28 the company accepted its charter. It is claimed that the new road will not parallel either the New York & New England or the Consolidated roads.

THE STANDARD THERMOMETER COMPANY, Peabody, Mass., is receiving for the "Upton" arc lamp continued evidences of approval in the shape of recent sales, which have been particularly gratifying. This company is also doing an excellent business generally, with its electrical manufactures, which argues creditably for the well-directed energies of Manager Henry G. Rice.

A NOVEL TEST of electric power is reported as having been made recently on the Nantasket Beach road. A heavy train, to which was attached a locomotive at one end and a motor at the other, was used for this purpose, and both engine and motor pulled together in opposite directions. The electric motor pulled train and locomotive easily, despite the fact that the latter was under full head of steam and pulling against it.

MR. PHILIP M. REYNOLDS, treasurer of the Anchor Electric Company, Boston, was included in a "stag" party which sailed this week for London, Eng., to be absent about six weeks. Those who know Mr. Reynolds will agree in the prediction that he will get all the enjoyment possible out of the trip, and also in the wish that if it be rough instead of pleasant his proverbial geniality and affability may not be permanently disturbed.

THE PERKINS ELECTRIC SWITCH MANUFACTURING COMPANY, of Hartford, Conn., has increased its capital from $50,000 to $125,000—made necessary by its rapidly growing business—and quite a large block of the new stock has been subscribed for by men of such business prominence as will strongly confirm the belief that the Perkins Company is doing an excellent and profitable business, and is managed intelligently and vigorously.

THE ROUTE OF THE NEW ELECTRIC ROAD to Holliston and Milford from South Framingham has been determined. It will leave the South Middlesex tracks on Waverley Street, go via Cedar, Pine and Hollis streets to Holliston. Surveys are now making for the route and the work will be rushed so that the road will be open as far as Holliston by Nov. 1. The Pierce Construction Company has the contract, and the capital for the enterprise is all subscribed.

THE NATIONAL CONDUIT MANUFACTURING COMPANY, of New York, well and favorably known everywhere, occupies a very prominent position in the underground work now in progress in the city of Boston. It is not only at present furnishing all the pipe for the subways, but its contracts cover also the laying of the pipe, the making of all excavations, refilling the same and repaving the streets. It is needless to say that this work is being done as usual in a manner to not only sustain its well-earned reputation, but to increase it as well.

A MONSTER ELECTRIC SIGN.—Boston is bright at night with electric signs of various sizes, but the champion sign of all is yet to come. It will be set up for the coming triennial conclave of the Knights' Templars on the Masonic Temple, at the corner of Boylston and Tremont streets, and consist of a Maltese cross 70 feet wide and high, in the centre of which will be a Salem cross 15 feet high, and on each wing an appropriate Knight Templar emblem about 10 feet high. A change in the lamps will be made every day so that the sign will have a different color each night.

THE W. S. HILL COMPANY'S assignment, while a great surprise to its many friends, is now generally regarded, all the circumstances being taken into consideration, as the very wisest step that could have been taken, as it will eliminate all the disturbing elements which have for quite a while operated to its detriment and progress. The business of the company, which, by the way, is now the best of its existence, will be carried on as usual by the assignee, Mr. Ferdinand A. Wyman, and through his exceptional business experience and energy the company will undoubtedly emerge from its temporary embarrassment in a better and stronger position. It is confidently believed that the company will pay dollar for dollar of its liabilities.

REDUCTION IN TELEPHONE RATES.—Last week announcement was made that the Southern New England Telephone Company would pay an increased rate of dividend. To-day the welcome announcement was made that notwithstanding this increase of dividend there is to be a very material decrease in the charge for telephone service. The new charges are based on monthly rates as follows: Business lines, single wire, $10 a month, party wire, $6 a month; house service, single wire, $4 a month; party wire, $3 a month. These are charges for the regular service within the half mile of the central office. Beyond that there has been a mileage charge of $10 per half mile for single wire and $2 per half mile for party service. That charge remains unchanged. The above rates will be charged in New Haven, Hartford, Waterbury and Bridgeport.

Western Notes.

Branch Office of the Electrical World,
936 Monadnock Building, Chicago,
July 27, 1895.

URBAN W. FRINK has been appointed Western manager for the A. W. Harris Oil Company, of Providence, R. I., with headquarters at 1325 Monadnock Building, Chicago.

H. M. BRINKERHOFF, electrical engineer for the West Side Construction Company, Chicago (known as the Metropolitan Elevated Railway Company), has awarded the contract for furnishing a telephone system to the Western Telephone Construction Company of Chicago. This system contemplates about 30 telephone outfits, one at each station, so that communication may be had from point to point.

EXTENSIVE PREPARATIONS are being made by the Chicago General Fixture Company, 169 Adams Street, Chicago, for a large fall trade in the popular Phœnix transformers, manufactured by the Louisville Electrical Works, Louisville, Ky., in Illinois, Iowa, Wisconsin, Michigan and Northern Indiana for which States the Fixture Company has secured exclusive control of these transformers. The company intends putting on several additional traveling salesmen, who will cover all the Middle and Western States and who will do their share toward introducing the Phœnix transformer into all the stations in their territory.

Canadian Notes.

Ottawa, Canada, July 26, 1895.

MILTON, ONT.—The Milton Electric Light & Power Company, with a capital of $15,000, has been incorporated.

MONTREAL.—The New Light Company of this city, with a capital of $60,000, has been granted a charter. W. Robertson, Angus M. Thom and J. A. E. Whyte are the first directors.

LINDSAY, ONT.—A charter has been issued to the Light, Heat & Power Company, of Lindsay. The capital stock of the company is $70,000. Wm. Needler, B. F. Reeser and Thos. Sadler, of Lindsay, are the first directors.

ST. JOHN, N. B.—The City Council has now under consideration an offer from the Street Railway Company to furnish the city with 129 electric lights, of 2 000-cp, at the rate of $85 per annum. The Board of Safety has recommended the acceptance of the offer.

WINNIPEG.—It is claimed that this city startles the stranger by its peculiar electrical condition during the winter months. There is no city in the Dominion where the air is more heavily charged with electricity than in Winnipeg, at least, so experts tell us.

WINCHESTER, ONT.—A charter has been issued to the Dundas County Telephone Company, with a capital of $40,000, to carry on a general telephone business in the county of Dundas, Ontario. Jay W. Nisbitt and James Moodie, of Winchester, are among the promoters.

TRENTON, ONT.—The Trenton Light, Heat & Power Company, with a capital of $50,000, are applying for a charter for the purpose of supplying light, heat and power to the town of Trenton. L. L. Merrifield, J. T. Westcott, M. M. Thompson and W. H. Pearson are to be the first directors.

QUEBEC.—The Quebec, Montmorency & Charlevoix Railway Company is acquiring the water power at Montmorency Falls, and have by parliament been given power to lease their surplus power and to enter into an agreement with the city of Quebec to construct and operate an electric street railway in that city.

INGERSOLL, ONT.—A charter has been issued to the Ingersoll Power & Light Company, with a capital of $45,000, for the purpose of distributing electricity for heating, lighting and power purposes in the town of Ingersoll. Stephen Noxon, John Gayfer, Henry Richardson, and G. E. Gayfer are the promoters of the company.

TORONTO.—The Canadian Electric Forging & Smelting Company, with a capital of $500,000, are making application to the Ontario Government for a charter for the purpose of carrying on forging, smelting, heating and the manufacture of chemicals by products, and gases, by electricity. Among the applicants for the charter is Geo. D. Burton, Boston, Mass.; J. R. Code and W. A. Johnson, Toronto, and W. P. Hartshorn, of Penn Yan, New York State.

OTTAWA.—The two acts relating to electric lighting which were passed by the Dominion Parliament last session are now in operation. One act legalizes units of electrical measure, and the other provides for a system of general inspection. The work is being carried on under the Inland Revenue department, and for the present the department's inspectors of weights and measures and gas will also act as inspectors of electric lights without additional remuneration.

OTTAWA.—The annual convention of the Canadian Electrical Association is to be held in this city in September. The officers of the association are: President, J. K. Dunston, Toronto; vice-president, C. B. Powell, Ottawa; secretary-treasurer, C. H. Mortimer, Toronto; committee, L. B. McFarlane, D. A. Starr, Montreal; F. R. Roseborough, J. J. Wright, J. A. Kammerer, Toronto; C. B. Breithaupt, Berlin, Ont.; John Yule, Guelph; J. W. Taylor, Peterbow; O. Higman, Ottawa.

English Notes.

(From Our Own Correspondent.)

London, July 18, 1895.

CENTRAL STATION FIRE RISKS.—The fire insurance companies are talking of raising the premiums for central station risks, in view of the two fires which have occurred in London central stations since the commencement of the year. This suggestion seems somewhat premature, and may possibly lead to supply companies on this side of the water mutually insuring themselves.

OBITUARY.—The death was announced last week of Rear-Admiral Arthur Cecil Curtis, who suddenly expired at Spithead in a boat, while returning from a visit to the Italian fleet now assembled there. Admiral Curtis was senior lieutenant of H. M. S. *Terrible*, when that vessel took part in the Atlantic Cable expedition of 1866, and he was promoted to the rank of commander for his services in connection therewith.

TRANSFORMER CHAMBERS.—In December last, owing to a dispute between the London County Council and various alternate-current supply companies, the Board of Trade held an inquiry into the question of the size of, and regulations to be adopted in regard to transformer chambers, which it was proposed to construct underneath the pavements. The Board of Trade decided that it had powers to settle this matter and decided in favor of the construction of such chambers. The companies, however, are still unable to obtain the consent of the local authorities, and a further inquiry by the Board of Trade is now promised.

ELECTRIC LIGHTING ENTERPRISE.—Under the electric lighting acts, promoters intending to obtain Parliamentary powers have to send in notices of their intention to the local authorities concerned, by July 1. In the Summer of 1889-90, there was a tremendous shower of such notices, but since then the number each year has fallen. This summer, however, there would appear to be a distinct revival of electric lighting enterprise, possibly due to the fact that a large number of brand new local authorities have been brought into existence by a recent act of Parliament, and promoters no doubt think it a good time to "rush" a large number of these authorities into some form of electric lighting plan.

MAGNETIC UNITS.—At the meeting of the British Association last year, Prof. Oliver Lodge, at the request of the Electrical Standards Committee, undertook to draft for future discussion, a paper on magnetic units. This paper is now being circulated among members of the British Association Committee, and with a view of obtaining opinions on this subject, from those who are not members of this committee, copies of Dr. Lodge's paper have been sent to the technical press. This paper states that the unit coefficient of self-induction should not be considered one of the fundamental units, and should be suitably defined with reference to other and more important quantities. It is also urged that the quantities $\mathfrak{H}$ and $\mathfrak{B}$ should be carefully kept distinct. The names "Gauss" and "Weber" are respectively adapted for the units of magnetomotive force and total magnetic flux. Several alternative systems of units are discussed.

General News.

NEW INCORPORATIONS.

THE SOLAR ELECTRIC COMPANY, New York, N. Y., has been incorporated with a capital stock of $100,000, by Hewitt Boice and Jacob Rice, Kingston, N. Y., and Samuel O'Connor, Brooklyn, N. Y., to make and sell electrical appliances.

THE LITTLE FALLS & RICHFIELD SPRINGS RAILWAY COMPANY, Little Falls, N. Y., capital stock $20,000, has been incorporated to build and operate an electric street railway in Herkimer County, 18 miles long. The promoters are C. L. Tylee, F. H. Vielle, G. E. Tylee, all of Corning, N. Y.

THE ELECTRIC WIRE HANGING INSULATOR COMPANY, Chicago, Ill. has been formed for the purpose of manufacturing, selling and dealing in insulators, clamps and hangers for all classes of electrical work. The incorporators are Edgar O. Baker, William A. Robertson and Henry W. Rice. Capital stock $200,000.

THE MANHEIM ELECTRIC LIGHT, HEAT & POWER COMPANY, Manheim, Pa., has been incorporated with a capital stock of $20,000, for the purpose of supplying light, heat and power by electricity. The promoters are Vance C. McCormick and Robert A. Carl, of Harrisburg, and F E. Bailey of Philadelphia.

THE ALBANY (N. Y.) & SUBURBAN RAILWAY COMPANY, capital stock $200 000, has been incorporated by R. F. Barnes, John S. Burke, George T. Cunningham, George B. Moore, Arthur Hilton, John Leggett, Albert J. Barnes and others, to construct a road to connect Greenwick, Castleton and Bath-on-the-Hudson with Albany.

THE RICHFIELD SPRINGS & SCHUYLER LAKE RAILWAY COMPANY, Richfield Springs, N. Y., has been formed for the purpose of building and operating an electric railway one mile long. Those interested in the project are C. L. B. Tylee, F. H. Vielle, C. M. Hyde, G. E. Tylee, all of Corning, N. Y.; capital stock $20,000.

THE NORTHWEST CONSTRUCTION COMPANY, Portland, Ore., has been incorporated for the purpose of constructing and equipping railways, electric car lines and motor roads, and for doing a general construction business. The promoters are T. H. Curtis, George Taylor, Jr., and F. R. Strong, Portland, Ore. Capital stock $1,000,000.

THE WEBBER BRAKE COMPANY, Jersey City, N. J., and New York City, N. Y., capital stock $50,000, has been formed to manufacture, buy and sell railway supplies for the construction and equipment of electric railways. Among the incorporators are George O. Lord, Clifton, N. Y.; Frederick S. Greene, Bayonne, N. J., and Otto R. Saint, New York.

THE SOUTHERN ELECTRIC CONSTRUCTION COMPANY, capital stock $25,000, has been incorporated at Richmond, Va., with J. M. Cullingworth, president; C. F. Wingo, vice-president; G. S. Maxwell, secretary and treasurer, for the purpose of instructing and equipping telephone plants and exchanges, electric light plants, and do a general electric business.

THE IDEAL ELECTRIC CORPORATION, Camden, N. J., and Philadelphia, Pa., has been incorporated with a capital stock of $100,000 to manufacture, install and maintain electrical apparatus. Among the promoters are George L. Colgate, Fanwood, N. J ; James D. McIntosh, Franklin, N. J.; George S. Loutey, William C. Toplin and James Collins Jones, Philadelphia, Pa.

THE GRAND BOULEVARD STREET RAILWAY COMPANY, 1942 North 17th Street, Philadelphia, Pa., capital stock $50,000, has been incorporated for the purpose of constructing and operating an electric railway. Among those interested in the project are O. M. Thomson, 1942 North 17th Street; Chas. P. Horr, John McLennon and Thomas C. McConnell, all of Philadelphia.

THE CORO & LAVELA RAILWAY & IMPROVEMENT COMPANY, Jersey City, N. J., capital stock $500,000, has been incorporated to construct, build and operate a railway to be operated by steam, or other motive power, between Coro and Lavela, Venezuela. The incorporators are Adolph Pereira and Francisco Bouilla, Brooklyn, N. Y., and George L. Dayton, Jersey City, N. J.

THE POCATELLO POWER & IRRIGATION COMPANY, Chicago, Ill., has been incorporated with a capital stock of $150,000, to operate water power plants, generate electricity for use in producing light and power and for mechanical purposes; to operate telephones and furnish water for irrigation and domestic purposes. The incorporators are Charles W. Spalding, Daniel Swinehart and Francis W. Smith.

ELECTRIC LIGHT AND POWER.

ARLINGTON, N. J.—The establishment of a new telephone system at this place is contemplated.

HAVERHILL, MASS.—An ordinance has been passed authorizing the burying of electric wires underground.

ST. LOUIS, MO.—It is reported that the city authorities are considering the erection of a new electric lighting plant.

CHESTER, PA.—The Pennsylvania Military College buildings are to be wired and fixtured throughout for electric lighting.

PEORIA, ILL.—An election has been called for Aug. 10 to vote on the question of bonding the town to erect an electric light plant.

CHIKO, CAL.—H. H. Clark, of San Jose, has been granted a franchise by the town trustees for an electric light and power plant here.

CHEROKEE, IA.—The Cherokee Electric Light & Power Company will enlarge and improve its plant at an estimated cost of $6,500.

BATAVIA, N. Y.—Messrs. G. W. Archer, J. Amstice and Frank Westcott, of this city, have applied for a franchise to light the streets of this city.

ELLWOOD CITY, PA.—A complete electric light plant is to be erected for the Weldless Tube Company, of this city. The secretary can be addressed for particulars.

LA PORTE CITY, IA.—It is reported that a local company has been organized for the purpose of establishing an electric light and water works system at this place.

ATHENS, GA.—Plans have been prepared for the erection of an electric lighting plant at Mitchell's Bridge. Every modern electrical improvement will be introduced.

NORFOLK, VA.—An ordinance has been passed granting the Subway Company the right to construct an underground system in this city. President Winston, of the Select Council, can give details.

CHESTER, PA.—Bids will be received for the construction of an engine and boiler house for the Chester Electric Light & Power Company. G. T. Denis, manager, can be addressed for further information.

ST. AUGUSTINE, FLA.—The erection of a new electric plant in this city is contemplated. E. M. Hammond, of Orlando; T. J. Appleyard, of Sanford, and George F. Napgood, of Maitland, are interested and can furnish further information.

GLOUCESTER, MASS.—The Board of Aldermen have authorized the committee on street lights to contract with the Gloucester Electric Company for 47 arc lights to burn all night 300 nights in the year, at $115 a year, and 41 incandescent lights at $15.60 a year.

THE ELECTRIC RAILWAY.

SENECA FALLS, N. Y.—The electric railway at this place is being extended.

SCHUYLER, N. Y.—It is reported that the Deerfield Street Railway is to be extended to Schuyler.

LOCKPORT, N. Y.—The construction of an electric railway from this place to Olcott is contemplated.

FRANKFORT, N. Y.—Work has been commenced on the construction of the electric road at this place.

MIDDLETOWN, CONN.—The Middletown Electric Railway is to be extended from this city to Cromwell.

SYRACUSE, N. Y.—The extension of the Syracuse Street Railway to South Onondaga is contemplated.

MIDDLETOWN, N. Y.—Work has been commenced on the extension of the electric road in the north end.

FINLEYVILLE, PA.—The people of Finleyville and of Liberty are agitating the building of an electric line.

HANSON, MASS.—The citizens are now talking of building an electric railway from this town to Whitman.

ROME, N. Y.—The Rome City Street Railway Company has decided to relay its tracks on the Dominick Street Line.

HARTFORD, CONN.—The Newington Tramway Company will build a trolley line between this city and New Britain.

ELIZABETH, N. J.—John Kean is interested in the proposed construction of a trolley line from this place to Summit.

HOT SPRINGS, ARK.—A company is being formed to build an electric road from Hot Springs to the Cuachita River.

OLDTOWN, ME.—It is reported that an electric railway is to be constructed through to Great Works, from this place.

ALLENTOWN, PA.—Work will be commenced shortly on the construction of the Allentown & Kutztown Electric Railway.

MAYVILLE, N. Y.—An electric railway is projected from Chautauqua through this place to Barcelona Harbor on Lake Erie.

DIGHTON, MASS.—Work has been commenced on the construction of the Dighton, Somerset & Swansea Electric Railway.

BURLINGTON, IA.—It is reported that the Burlington Electric Railway Company will extend its lines to West Burlington.

BRUNSWICK, GA.—It is reported that an electric street railway system is to be established here. Col. W. A. Geter is interested.

CHATTANOOGA, TENN.—The extension of the Chattanooga Electric Railway is contemplated from this place to Rossville, Ga.

NEW BRUNSWICK, N. J.—It is reported that the trolley line is to be extended from this place to Metuchen and Boundbrook.

TRIMBLEY, N. J.—A new trolley road is projected which is to run through Union County from this place across to Springfield and Summit.

PITTSBURG, PA.—The construction of an electric railway from Chicago to this city is contemplated. W. A Magee, of Pittsburg, is interested.

UTICA, N. Y.—The Utica & Herkimer Street Railway Company has applied for permission to build and operate an electric railway through this city.

PITTSBURG, PA.—Work has been commenced on the construction of the line from Twenty-third to Main streets by the Fort Pitt Street Railway Company.

HILLSBORO, TEX.—The Hillsboro Street Railway Company is contemplating the construction of a trolley line at once. J. H. Graham, of Boston, is president.

RICHMOND, VA.—It is reported that the Richmond Railway & Electric Company is contemplating the extension of the system along Broad and other streets.

MCKEESPORT, PA.—The Versailles Traction Company has decided to erect a large power house in McKeesport, for its line between this city and Boston, Pa.

AUGUSTA, GA.—The Augusta Street Railway Company is contemplating the extension of its line to Lake Olmstead. D. B. Dyer can furnish detailed information.

MILFORD, DEL.—An electric railway is projected to connect this town with Dover. Permission has been granted the company to lay its tracks and operate the cars.

FALL RIVER, MASS.—The Globe Street Railway Company has applied for a franchise to construct, operate and maintain an electric railway through certain streets.

OGDENSBURG, N. Y.—The Ogdensburg Street Railway Company has increased its capital stock from $75,000 to $150,000, and will convert its line into a trolley system.

YEADON, PA.—An ordinance has been passed by the Borough Council, granting the Delaware County Railway Company right of way over certain streets of this place.

CINCINNATI, O.—Herbert Miles, 902 Neave Building, is organizing a company for the construction of a four and one half mile suburban electric railway in Southwestern Ohio.

BALTIMORE, MD.—The South Eutaw branch of the Baltimore Passenger System is to be equipped with electricity and operated as a trolley line. Walter S. Franklin is president.

CHESTER, PA.—An ordinance has been passed granting the Prospect Street Railway Company the right to construct, operate and maintain a street railway in the borough of Prospect Park.

LONG BRANCH, N. J.—The Long Branch commissioners have granted the West End & Long Branch Railway Company permission to operate a double-track railway on Second Avenue.

SYRACUSE, N. Y.—The Syracuse & Oneida Lake Electric Railway Company has been granted permission to construct, maintain and operate a single-track surface street railway through the city.

SPRINGFIELD, O.—A franchise has been granted to the Springfield, Cedarville, Clifton & Jamestown Electric Railway Company to construct and operate an electric railway between the points named.

SPRINGFIELD, MASS.—The Woronoco Street Railway Company has awarded the contracts for an engine for its new plant to the Stearns Company, of Erie, and for a generator, to the Westinghouse Company.

SOUTHBRIDGE, MASS.—It is proposed to build a seven mile electric road at an estimated cost of $100,000, from Sandersdale to Globe Village. C. D. Paige, of the Board of Trade, and Thomas P. Robinson are interested.

SOUTH ORANGE, N. J.—The South Orange Board of Trustees have granted the South Orange & Maplewood Street Railway Company a franchise to lay tracks on South Orange Avenue, and work will be commenced soon.

PITTSBURG, KAN.—The Kansas & Missouri Electric Railway Company has been chartered for the purpose of constructing a railway line in Crawford County. Samuel Barrett and Robert Bobbin, of this place, are interested.

CICERO, ILL.—The city authorities have passed an ordinance giving the Chicago & Northern Pacific Railway Company the right to erect poles and wires, and to use electricity instead of steam as a motive power within the city limits.

PHILADELPHIA, PA.—An action has been begun by James Fynon and others against the Philadelphia Traction Company to restrain the latter from laying down a double track on East Susquehanna Avenue, from Memphis to Beach Street.

NEW BRITAIN, CONN.—The matter of an electric road between this city and Hartford is assuming definite shape. The Central Railway & Electric Company prefer to build the line via Stanley Quarter. About $15,000 will be necessary for the proposed line.

LOWELL, MASS.—The Lowell & Suburban Street Railway Company appeared before the Railway Commissioners this week with a petition asking for the approval of an issue of $400,000 stock for the purpose of reconstruction and equipment with electricity.

BATESVILLE, IND.—The Batesville & Oldenburg Railway & Electric Company, B. S. Sutton president, has been granted a franchise. Work will begin in 60 days on the section between Batesville and Oldenburg, and afterward extend to Osgood, 16 miles south.

BUFFALO, N. Y.—Sealed proposals will be received by the Buffalo, Gardenville & Ebenezer Railway Company, 47 Dun Building, this city, for furnishing the material and constructing an electric railway, four and one third miles in length. Charles Schoepflin is president and can furnish particulars.

ST. JOSEPH, MO.—The first step in the building of an electric line to St. George has been taken by the St. Joseph Traction & Lighting Company. The company agrees to commence work within 90 days after the passage of the ordinance, and have the road completed within six months thereafter.

NEW ORLEANS, LA.—St. Bernard Parish is to have an electric railway. It will be constructed by the Chaumette Railway Company in which the following are interested: R. V. Ducros, E. E. Nunez, C. D. Armstrong, L. Roy, A. Estopinal, Jr., Senator A. Estopinal, B. Ojeda and J. D. St. Alexandre.

MT. CLEMENS, MICH.—The Mt. Clemens Street Railway and Lakeside Street Railway companies have consolidated and reorganized under the name of Mt. Clemens & Lakeside Traction Company. The new company will equip all its lines with electricity as rapidly as possible, and add many attractions to its system.

MILWAUKEE, WIS.—A franchise has been asked for by Chicago capitalists, headed by Congressman McGann, to build an electric line from South Milwaukee through the city to North Milwaukee. The enterprise is backed by ex-Congressman Peter J. Somers and other local capitalists. A four-cent fare is promised.

WESTFIELD, N. Y.—W. L. Minton and his attorney, A. B. Ottoway, of Westfield, have secured an option for a year and a half on most of the right of way between Barcelona and Mayville. The project of an electric road from Lake Erie to the Chautauqua Assembly Grounds is contemplated and this is a move in that direction.

ST. LOUIS, MO.—A license has been granted to the Southern Electric Railway Company by Secretary of War Lamont to lay tracks in the Government reservation at Jefferson Barracks. Winthrop Bartlett is the engineer in charge, and the officials say that the addition between its southern terminus, at River des Peres and Jefferson Barracks, will be ready for traffic on Oct. 1.

MISCELLANEOUS NOTE.

THE JOHNS HOPKINS UNIVERSITY makes the following announcement in relation to its course of applied electricity for 1895-96: The work in this course is intended to give the students a thorough theoretical knowledge of the subject, with such examples in electrical practice as will fit them to apply the latest discoveries in electrical science to the more important practical problems of the day. In applied electricity especial attention is given to the electrical transmission of energy, electric traction, and alternating-current work. The course includes lectures on theoretical and applied electricity and electrical measurements, with so much of mechanical engineering as seems necessary. An important feature is laboratory work, to which much attention is paid, and original investigation is especially encouraged. The instruction is given by H. A. Rowland, professor of physics; Louis Duncan, associate professor of electricity; Hermann S. Hering, associate in electricity, and H. G. Geer, instructor in mechanical engineering. The work extends through two years and is intended principally for graduate students. Those who have taken the physical-mathematical or the physical-chemical course in this university are especially well prepared, but all students must satisfy the instructors that they are fitted to pursue the course. Candidates for admission must have completed the major and minor courses of this university (or their equivalents elsewhere) in physics and mathematics, the minor course in chemistry, and the course in freehand and instrumental drawing, and must be able to read either French or German. Those who have not had all this preparatory training must follow the courses in which they are deficient. A certificate of proficiency is given to those students who complete the prescribed course in a satisfactory manner, and who possess a knowledge of both French and German.

Trade and Industrial Notes.

REMOVAL.—The Electric Construction & Supply Company, formerly of 3 East Eighth Street, Wilmington, Del., has removed to 8 West Sixth Street, where larger quarters and better facilities will be enjoyed.

VOCAL EXERCISE is being liberally provided for by the Western Telephone Construction Company, 539 Monadnock Building, Chicago. Among numerous other smaller orders recently taken, 75 telephones have been sold at Murphysville, Ill.; 100 at Wapakoneta, O., and 300 at Altoona, Pa.

AFTER A PROLONGED TEST of two No. 5 Reliance columns, manufactured by the Reliance Gauge Company, Cleveland, O., the Boston Electric Light Company has adopted them, and has ordered 12 for the central station, 11 for the Ferdinand station, three for East Boston and two for South Boston stations.

THE BEACON LAMP COMPANY, of Boston, has just closed with the American Tract Society, of New York, for the installation of 3,000 16-cp lamps in the society's new and handsome building on Nassau Street. This order was obtained by General Manager Haubay, and in the face of strong competition, and the results should be exceedingly pleasant alike to the Beacon Company and to Mr. Haubay.

THE AMERICAN FLAG is too well known to require any special effort to familiarize the public with its beauty and worth. The American Flag dry battery, however, is a more recent production, and in order to impress its merits upon the Western trade the manufacturers, W. B. Anderson & Company, 177 Grand Street, New York, have wisely placed the agency with the Electric Appliance Company, 242 Madison Street, Chicago.

A NEW MOTOR-STARTING RHEOSTAT has been brought out by the Hayes-Fyfe Company, of 1006 Pontiac Building, Chicago, the chief feature of which is the use of iron contact-plates which are magnetized by the motor current and thus hold the contact-roller in any desired position until the flow of current ceases, when the roller is released, the arm returned to the starting point and a double-pole switch opened, automatically cutting the motor entirely off from the supply circuit.

THE LOUISVILLE ELECTRICAL WORKS, Louisville, Ky., report a large and steadily increasing demand, even at his dull season, for the Phœnix transformers, and has found it necessary to add new machinery and otherwise increase its facilities in order to properly and promptly take care of orders. The following agencies have been established: J. A. Machado, 208 Broadway, New York; Vallee Brothers & Co., Philadelphia; Russell & Officer Electrical Construction Company, Denver, and W. T. M. Mottram, Dallas, Tex.

THE SOUTH, with all of its magnificent resources, has up to the past few years been a sealed book as regards the full development of the electrical

industries, and it gives us pleasure to note the establishment, at Richmond, Va., of one of the largest electrical manufacturing and supply houses in that section, under the style of the Mason Telephone Company. This company was organized and formerly located at Sumter, S. C., for the manufacturing of telephones and telephone apparatus, but the rapid growth of its business made it necessary to secure a position better suited for a distributing point, and at which could be secured labor and better facilities than were available at Sumter. The company therefore closed its factory at Sumter and opened a large five floor factory and supply house at Richmond, Va. This building is equipped with the latest and most modern machinery necessary for the manufacture of electrical goods of all kinds. In addition to the telephones, switchboards, generators and other telephone supplies manufactured by this company, a full line of general electrical supplies is carried. The company informs us that it is now over 1,000 instruments behind in its orders besides a number of switchboards and other supplies. It is making a bid for the Southern business, and should be in a position to secure it, having the most complete manufacturing plant in the entire South, and being backed up by some of the most successful business men in that section. The Mason telephones are now in use in a great many States, and are giving universal satisfaction.

Business Notices.

ELECTRIC LEAGUE.—Meets every Thursday evening, 100 West 24th Street, New York. Electrical engineers and electricians cordially invited.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren Street, Syracuse, N. Y.

IN THE ADIRONDACK MOUNTAINS.—Persons contemplating a visit to the Adirondack Mountains should by all means possess themselves of a copy of the delightful book, just issued by the New York Central, bearing the above title. It will not take long to read, for it contains only 64 pages, but every page bristles with information of just the practical kind one wants at such a time. You can take this book and in half an hour secure a good general idea of the Adirondack region—its grand divisions, characteristics of each, the location of the principal resorts, and how to reach them.

Not the least valuable feature is a fine new relief map, printed in four colors, showing the correct location of all the principal mountains, lakes and streams; also all stage lines, wagon roads and carries, and on the back a complete list of hotels, cottages and camps—location, dates of opening and closing, rates, etc. There is, probably, no other book published on the Adirondack containing in such compact and readable shape so much useful information.

A copy will be sent free, postpaid, to any address in the world on receipt of two 2-cent stamps, by George H. Daniels, General Passenger Agent, Grand Central Station, New York.

A TREASURE FOR TOURISTS.—"Health and Pleasure on America's Greatest Railway," No. 5, of the Four-Track Series for 1895, issued by the Passenger Department of the New York Central, from the press of the American Bank Note Company, surpasses in size and beauty any volume of like character ever published. No brief description can give an adequate idea of its excellence and utility. To summarize it in a few words, the book is a handsome volume of 504 royal octavo pages, with numerous maps and illustrations, beautifully bound in illuminated covers. The primary object of the book is to give useful information regarding the popular health and pleasure resorts of New York, New England and Canada, but it goes beyond this scope, and in a series of interesting chapters treats of the beauties of landscape and climate to be met with in California, Colorado, Utah, Yellowstone Park, Mexico, Japan and the Hawaiian Islands. The descriptive matter relating to the various features of interest in these localities is accompanied by over 300 illustrations, depicting the most beautiful scenery of the country. In addition to these features, epitomized tables of routes, fares, hotel rates, etc., etc., render the book invaluable to traveler and tourist. The maps are all new and up to date, and cover the Adirondack Mountains, Thousand Islands, Lake Region of Central New York and all the prominent resorts.

Everyone who intends to get out of the city for the summer should secure a copy of this book and study the 1,000 tours it describes before coming to a decision. George H. Daniels, General Passenger Agent of the New York Central, will send a copy to any address in the world upon receipt of ten 2-cent stamps.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JULY 23, 1895.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

542,982. PRODUCING PURE ELECTRIC LIGHT CARBON; E. G. Acheson, Monongahela City, Penn. App. filed Aug. 25, 1894. A method of producing pure carbon which consists in granulating coke and subjecting it to the required degree of temperature necessary to volatilize the impurities associated with it.

543,000. ELECTRICAL TIME ANNUNCIATOR; E. M. Edgerton, Chicago, Ill. App. filed Feb. 12, 1892. The combination of an electric circuit having clock work, annulus, a switchboard and a pivoted switch bar connecting the terminals of a break in the circuit, and a push button for closing the auxiliary circuit and causing the release of the switch bar so as to open the main circuit.

543,003. ELECTRO-MEDICAL APPARATUS; J. R. Etter, Crawsfordville, Ind. App. filed June 19, 1893. The combination of a switch, metallic connections and switch levers comprising a battery lever, a double and a single galvanic lever, pole changing, controlling, selecting and cautery levers for the purpose of regulating and minutely controlling the electric currents.

543,016. INCANDESCENT LAMP SOCKET; E. H. Heath, Grand Rapids, Mich. App. filed March 21, 1895. A socket having a chamber in its side, a screw threaded socket, a diaphragm, bolts through the diaphragm carrying fusible wires extending to the binding posts on the said diaphragm.

543,021. DYNAMO-ELECTRIC MACHINE; T. Hooker, Syracuse, N. Y. App. filed April 26, 1894. A machine consisting of field magnets having severed pole-pieces forming independent working faces of like polarity connected in series with the said field magnets and polarized in such a direction as to reinforce the entering horn of the field magnet and decrease the trailing horn of the same.

43,042. TROLLEY WHEEL; C. Mitchell, Yonkers, N. Y. App. filed Dec. 20, 1894. A trolley wheel having insulated collars fitting on the axle projections, contact balls arranged within the said collars, and side contact pieces attached to the side bearing frames and provided with central contact bosses fitting into the outer open ends of the said collars and contacting with the said contact balls.

543,055. SECONDARY BATTERY PLATE; J. J. Roodey, Brooklyn, N. Y. App. filed Nov. 19, 1894. A plate consisting of a base and a coating plate, perforations in one plate being smaller than in the other, the plates being united with their perforations registering concentrically to form a grid having openings through it.

543,063. FIRE ALARM BOX; J. T. Stack, Chicago, Ill. App. filed Jan. 2, 1894. An alarm box having non-interfering devices controlled by the first movement of the handle, and a releasing lever controlled by subsequent movement.

543,086. REGISTERING ARMOR FOR BOXERS; J. Donovan, Chicago, Ill. App. filed Dec. 19, 1894. An armor consisting of a cushion or cushions located over vulnerable parts of a wearer when in use, and means for indicating the number of times each or all of the cushions are struck.

543,089. METER FOR ALTERNATING ELECTRIC CURRENTS; Ludwig Gutman, Pittsburg, Pa. App. filed May 20, 1890. In an electric meter, the combination with an armature having part of its conductor lying in a given plane and the remaining part in another plane, of a primary coil and a secondary coil in inductive proximity thereto, the two coils having their axes lying parallel to each other in the same plane.

543,108, filed May 10, 1895; 543,104, filed May 10 1895; FIRE ALARM BOX; C. A. Rolfe, Chicago, Ill. A box consisting of a chamber having a telephone instrument, which can only be used by unlocking an inner door, the circuit being broken when the door is closed.

543,106. VILLAGE TELEPHONE SYSTEM; C. E. Scribner, Chicago, Ill. App. filed July 2, 1886. The combination of a bell in circuit, a generator, a number of telephone lines extending to sub-stations and a switch for connecting the generator in circuit with any of the said lines, and also a switch for disconnecting the bell from the line and connecting it to the generator.

543,130. UNDERGROUND TROLLEY SYSTEM; N. B. Ginochio and H. C. Bridger, Woodbridge, N. J. App. filed Dec. 27, 1894. A system having a main supply wire and a contact line, with switches secured to the contact line, levers having upwardly extending arms to make contact.

543,160. TELEPHONE EXCHANGE; W. Y. Shibata, San Francisco, Cal. App. filed Oct. 11, 1894. The combination of parallel bars arranged in series, with independent plates secured thereto, tracks mounted upon the plates, cars adapted to travel thereupon, arms depending from the cars to make contact with the various plates, exchange boxes located at the station of each subscriber provided with indicators, and switches and contacts so that the cars will move and establish any desired connection.

543,186. CARBON HOLDER; J. C. Knight, New York, N. Y. App. filed Jan. 15, 1895. A socket provided with a dust discharge opening in its bottom and set screws extending through bosses located on the walls of the socket at 120 degrees apart, two of which are adapted to be set for a particular size of carbon, while the third is in the form of a thumbscrew for frequent manipulation.

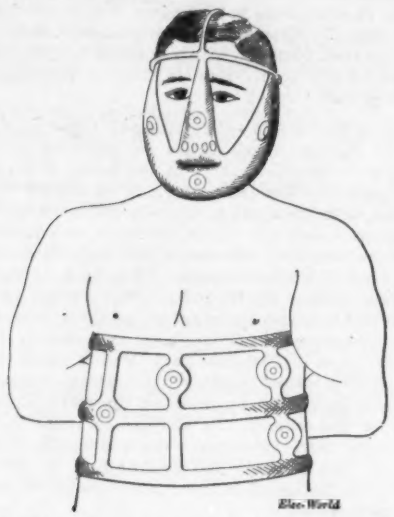
543,190. ART OF TELEPHONING; A. E. Paige, Philadelphia, Penn. App. filed Feb. 25, 1895. The combination of a pair of electrodes in unvarying relation to each other, provided with an intermediate receptacle, a liquid conductor coated with a film, it completing the circuit between the said electrodes, and means for disturbing the liquid conductor in conformity with sound waves.

543,198. ELECTRIC CURRENT DISTRIBUTER; E. Thomson and E. W. Rice, Jr., Swampscott, Mass. App. filed April 24 1894. The combination of an electromagnet and an armature controlled thereby, a biased circuit breaker in circuit with the magnet, and soft solder holding said circuit-breaker against its bias in electrical contact with the coil.

543,223. ALTERNATING ELECTRIC MOTOR; J. A. G. Trudeau, Ottawa, Can. App. filed April 6, 1894. The combination of suitable field magnets, rotatable armature having a circumferential iron hoop, and a non-magnetic central portion, and an energizing coil encompassing the armature and having its outer folds within the inner circumference of the hoop, so that that portion of the hoop outside of the coil will be of the same polarity through its entire thickness.

543,231. WRITING TELEGRAPH; T. Ewing, Jr., Yonkers, N. Y. App. filed Jan. 9, 1894. The combination of a transmitter station device for sending to line two sets of currents and means for returning to its neutral position the device for sending one of the sets of currents upon each operation of the device for sending the other set of currents.

543,241. WRITING TELEGRAPH; W. E. Gump, Brooklyn, N. Y. App. filed Feb. 24, 1894. The combination of sets of three wheels each, one of the wheels of each set being power-driven and engaging with the others, a pen driven by the two sets of wheels, a paper shifting magnet, and means operated by this magnet for throwing both of these power-driven wheels out of engagement with the others.



No. 543,086.—REGISTERING ARMOR FOR BOXERS.

543,243. ELECTRIC ARC LAMP; D. Higham, Boston, Mass. App. filed May 2, 1895. An electric lamp having arcs connected in series, suitable feeding mechanism provided with series magnet windings controlling the same to regulate the current at the desired amount, and means whereby the normal lengths of said arcs are maintained by the heat given out by said arcs.

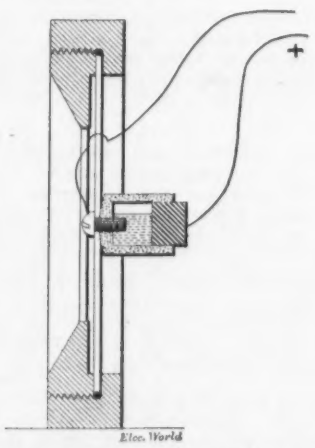
543,271. TROLLEY STAND AND POLE; L. C. Seelye, Fort Edward, N. Y. App. filed Jan. 2, 1895. The combination of a trolley pole having springs secured thereto, a base, a slide to lock the springs to the base and a lever fulcrumed on the base and connected with the slide, and oppositely extending cords to work the lever.

543,280. INCANDESCENT LAMP; G. Westinghouse, Jr., Pittsburg, Pa. App. filed Aug. 29, 1892. A lamp having a continuous outer end or rim provided with integral springs having bends near their free ends and a bulb provided with an integral flange adapted to be supported in said bends.

543,313. TELEPHONE TRANSMITTER; Z. E. Patrick, Chicago, Ill. App. filed Jan. 18, 1895. A transmitter consisting of an inclosing case, a conical shell having its base fastened to the front of the case, a body of variable resistance fixed rigidly upon the side wall of the shell and within the case and an electric current passing through the body of variable resistance.

543,322. RAILWAY SIGNAL; J. B. Stewart, Haverstraw, N. Y. App. filed Aug. 24, 1894 An electromagnetic clutch consisting of a shaft, a portion of which forms the core of the magnet of the clutch, a coil or helix mounted thereon, and a winding drum magnet also loosely mounted on said shaft, a portion of which drum is of magnetic material.

543,328. TELEPHONE ATTACHMENT; C. E. Bertels, Wilkesbarre, Pa. App. filed March 20, 1895. An attachment for supporting a telephone consisting of two pivoted arms having a hinged connection with each and with a stationary wall bracket, a clamping arm swiveled to the end of the outer arm so as to be capable of being revolved relatively therein and adapted to receive a telephone receiver.



No. 543,190.—TELEPHONE TRANSMITTER.

543,336. ELECTRIC REGISTERING APPARATUS; A. Custodis, Dusseldorf, Germany. App. filed March 19, 1895. An apparatus consisting of a vessel and inclosed suspended movable contact, a pair of coils of which one is connected to the contact and the other to a fixed resistance, a pointer controlled by the coil-cores and a battery.

543,346. ELECTRIC TRANSFORMER; J. A. Mosher, Chicago, Ill. App. filed May 7, 1895. The combination of a primary cell, a terminal block for carrying the terminals of the primary coil and the main circuit, and a contact plug adapted to connect both ends of the circuit with the primary coil.

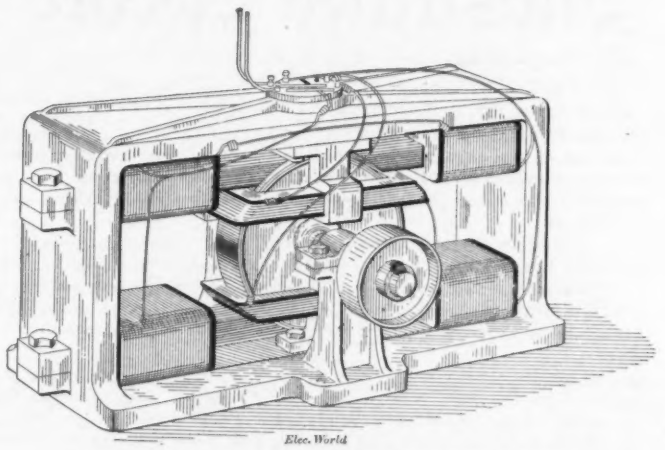
543,355. ELECTRIC ARC LAMP; H. J. Sage, Chicago, Ill. App. filed Feb. 13, 1895. A lamp having a revolvable drum around the periphery of which a ribbon supporting the upper carbon is wound, a friction drum, both drums being supported so as to permit of an up and down movement, a friction band in contact with the said friction drum and so arranged as to be capable of raising and lowering the drum as well as of supplying friction sufficient to prevent rotation thereof, and operating mechanism connecting the friction band with an electromagnet whereby the latter is capable of controlling the movements of the ribbon drum and allowing it to be first lowered and then unwound.

543,357. ELECTRIC TRANSPORTATION SYSTEM; R. E. Sherman, Chicago, Ill. App. filed March 1, 1895. In an overhead system of mail transportation, the combination of out-going and return circuit lines supported one above the other on posts, a mail bag receptacle, a metallic frame supporting the receptacle, a driving contact wheel on a shaft carried by the frame and by which the frame is suspended on one of the lines, and an electric motor suitably insulated with its armature shaft geared with the contact wheel, and a switch.

543,358. ELECTRIC CLOCK-WINDING MECHANISM; L. H. Spellier, Philadelphia, Pa. The combination of an electric motor having a mutilated commutator and a weight acting to complete the movement of the parts actuated by the motor, a spring wound by parts actuated by the motor and the weight, the spring having means adapted in unwinding to automatically re-establish at a predetermined tension of the spring electrical connection with the mutilated commutator.

543,364. TESTING CIRCUIT FOR ALTERNATING-CURRENT SYSTEMS OF DISTRIBUTORS; H. C. Wirt, Schenectady, N. Y. A means of testing which consists of mains, transformers having their primaries in multiple arc across the mains leads from the transformers to the central station, a galvanometer and suitable switching appliances arranged to connect the galvanometer and a source of E. M. F. in circuit, with either one of the leads from the transformers and with either one of the mains at will.

543,372. SECONDARY BATTERY; E. Boetticher, Leipsic, Germany. App. filed May 12, 1890. A battery consisting of a zinc oxide solution, a zinc cathode and a non-conducting covering that extends over the lower surface, the rim and the vertical stem of the cathode.



No. 543,223.—ALTERNATING-CURRENT MOTOR.

543,382. ELECTRIC RAILWAY SYSTEM; J. C. Henry, Westfield, N. J. App. filed May 13, 1895. A system of current distributing which comprises one or more road conductors divided into sections insulated, two generators of different E. M. F. couples in series and feed conductors connected with said generators in the three-wire voltages and supplying current of different voltages to different sections of the road.

543,383. DYNAMO-ELECTRIC MACHINE; T. H. Hicks, Detroit, Mich. App. filed Jan. 13, 1894. An electric machine consisting of a commutator constructed with annular grooves toward the extremities of the commutator, wire bands located in these grooves and insulated, and rings located upon the said wire bands.

543,399. ELECTRIC ARC LAMP; S. E. Nutting, Oak Park, Ill. App. filed Oct. 5, 1894. The combination of a device for separating and moving the carbons which consists of an electric conductor attached to fixed brackets and adapted to expand by heat, a carbon carrier, and a device actuated by a derived or a shunt current around the arc to release the carbon carrier.

543,409. ELECTRIC SWITCH; H. Stuebner, Philadelphia, Pa. App. filed Jan. 19, 1895. The combination of two rods, a block provided with seats for the said rods and having a hub, and a spring coiled around the hub and having its ends in direct engagement with the rods.

543,425, filed Jan. 9, 1894; 543,426, filed Dec. 19, 1894; 543,427, filed March 21, 1895; 543,428, filed March 21, 1895; 543,429, filed March 21, 1895. WRITING TELEGRAPH; J. H. Robertson, Brooklyn, N. Y. In a writing telegraph machine the combination of a resistance through which the writing impulses are sent, a friction contact adapted to send an impulse direct to line when the movement of the transmitting pen is reversed and the resistance is cut out.

543,445. ELECTRIC ARC LAMP; W. Jandus, Cleveland, O. App. filed Dec. 19, 1894. The combination of an arc inclosing globe, an outer globe or chamber fitted air-tight at its upper end to the lamp, the said globes being constructed and arranged to insure an envelope or reservoir of chemically inert gases around and in communication with the body of gas in the arc-inclosing globe.